Walks in the Garden of Science
Selected Papers and Lectures

Pieter J.D. Drenth
President ALLEA
2000-2006
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The ALLEA Strategic Outlook which is now under discussion, explains Academies’ characteristic set of objectives as follows: "The attempt to further the critical thinking in a society, the desire to advance top level scientific and scholarly research and the promotion of independence and freedom of science as a *sine qua non* for its advancement.” Indeed, these objectives have been a driving force for scientific thought from Plato’s time, gaining new momentum in the 17th century with the founding of the modern academy, right up to the present.

This collection of papers and addresses by Professor Pieter Drenth, ALLEA’s President during 2000-2006, reflects many of those ideas. Pieter is an international authority in behavioural sciences, which includes theories on intelligence, organizational psychology, cross-cultural comparative studies etc. His wide experience in administrative and management positions has made him an expert in science policy. His book *Gardening in Science*, published in 1996, is the account of his experience as the President of the Royal Netherlands Academy of Arts and Sciences. Now his attention is mostly focused on the international community. In ALLEA, Pieter has been a dedicated advocate for a Europe of knowledge and trust in science.

The chapters are arranged around three themes: Science Policy, Science and Ethics, and the Role of Academies. Pieter asks many fundamental questions: whether basic or applied research should be favoured, whether science is value-free or value-bound, what a scientist’s responsibility is, what role Academies play etc. He also provides answers based on a detailed analysis and clear reasoning, thus sorting out the pro’s and con’s. The list of topics that he tackled includes: science does matter, communication is a vital necessity, integrity in science is important as well as social responsibility, science is needed for detente and peace, ethics and science are inseparable... . This list can be easily extended, because Pieter as a scientist and a scholar cares about knowledge and science.
For many years, Pieter has been very active, serving ALLEA with much dedication and energy. Through Pieter’s talks and addresses, ALLEA’s voice has been clearly heard, and the scientific community should be very proud of him. Having such a strong basis on which to build, it is a privilege to start serving ALLEA as the next President – the ideas of ALLEA within this collection are embedded in a nexus of science and society where frontier research matters. Thank you, Pieter!

Jüri Engelbrecht
President-elect of ALLEA
January 2006
Preface

This volume contains a compilation of papers and addresses presented by Pieter J.D. Drenth during his presidency of the All European Academies (ALLEA) from 2000 to 2006. Most of these addresses have either never been published, or have been included in proceedings that are not easily accessible. We thought that publishing these writings and addresses in a single volume would be of service to ALLEA’s member academies and others who are interested in meta-science and science policy problems. At the same time, this publication is a tribute to the author, who has not only served ALLEA heart and soul, but with wisdom in accordance with his motto *inter utrumque tene*. In other words, ‘keep the right balance’ between, in this case, ALLEA’s interests as the guardian of science’s autonomy, and as provider of policy and advice to the international community. As President of ALLEA, Pieter J.D. Drenth has developed into an elder statesman of science and scholarship.

In some respects, the volume’s title, *Walks in the Garden of Science*, continues an earlier and similar tribute that the Royal Netherlands Academy of Arts and Sciences paid to Pieter Drenth on his resignation from the Academy’s presidency in 1996. That anthology — a collection of his writings and presentations during his six-year service as President of the Netherlands Academy, was titled *Gardening in Science*. The current word ‘walks’ implies a somewhat more reflective and observational attitude than the more active ‘gardening’. And this is indeed the perspective that is characteristic of his contributions to the debate on science and science policy in Europe: a searching approach based on a profound analysis of the issues and their ramifications.

The papers have been divided into three sections: on science policy, on science and ethics, and on the role and functioning of Academies of Sciences and Humanities. In the first section, the emphasis is on the importance of science and scholarship for Europe’s civilisation and economic growth. In the second section, attention is paid to the social and ethical concerns created by the increasingly rapid developments in science and technology. The last section focuses on the role that Academies of Sciences and Humanities could
play in and the contribution that they could make to these debates, and the requirements that have to be met for them to have a salutary effect.

Since most of the papers have not been published, but were delivered as a presentation at a conference, or to an audience during a visit to a particular Academy, the reader may find some overlap between the contributions, but this has been avoided as far as possible through the judicious selection of chapters. It is a great pleasure to present this volume and we hope that the reader finds it stimulating and informative.

Johannes J.F. Schroots  
Director ALLEA
Section I
Science Policy
Introduction

According to Dixy Lee Ray the general public has long been divided into two parts: those who think science can do anything, and those who are afraid it will. Apart from the totally diverging appreciation of its effects, this statement suggests that in fact all of us react affirmatively to the question: does science matter?

In a more serious vein, affirmative answers to this question can also be heard from responsible official sources: 'Relevant science' is one of the corner stones of European Commissioner Busquin's successful plea for a European Research Area. The UK's Prime Minister Blair acknowledged the importance of science for the future of his country in a speech at the Royal Society last year (23 May 2002). On 20 January this year, the Irish Deputy Prime Minister Harney stated: "In today's economy, neither natural resources, cheap labour, nor capital stock are as important to the national competitive advantage as innovation built on new ideas and new knowledge." Recently one of the governors of the French CNRS, Henri Audier, warned in Le Monde (8 April 2003) that if Europe wants to preserve its role in the world of tomorrow "il est grand temps de fixer comme priorité l'éducation, la formation, la culture et la recherche". The power of a nation, wrote the Nobel laureate François Jacob in the same issue of Le Monde, was long measured by that of its army. Today, he continued, "elle s'évalue plutôt à son potentiel scientifique." These and many other officials all stressed the importance of science for our economic and social future; in other words, they stressed the relevance of science.

Of course, the discussion on the relevance of (natural, social and human) sciences is not new. It has been the subject of extensive discussions in the Western world during past decades, especially since the neo-Marxist ideologists in the 70s propagated that relevance was equal to the extent to which sciences contributed to the emancipation of the lower classes and to the general ideals of equality and a free and democratic society. Much of the more recent political debate on the appropriateness of scientific research is presented at the Budapest Science Forum 2003: Knowledge and Society, Budapest, 8-10 Nov. 2003, Hungarian Academy of Sciences.
rooted in a quite different, and equally narrow, definition of relevance, namely as the contribution to industrial and economic growth and development. There is also relevance as seen through the eye of the technologist who sees the relevance of science in simple instrumental terms: the extent to which it furthers the availability of valid and useful instruments for practical application. Clearly, the relevance and usefulness of science refer to diverging goals and contexts, and will be defined differently by various users.

**Types of relevance**

It may be appropriate to elaborate on this concept of relevance. I propose a distinction between four types of relevance:

In the first place there is *intrinsic* relevance, which goes beyond economic value and practical applicability. Research, be it in the natural sciences, in the humanities or in the social sciences, leads to an augmentation of the body of knowledge, an intrinsically valuable and precious quality of civilisation. Raising questions on the nature and determinants of observed phenomena is a fundamental and unique characteristic of the human species and a motor for its development.

It is clear that the continuity of this scientific discourse appears to its full advantage in a dialogue with the next generation. In other words, intrinsic relevance is strongly related to the educational mission of science: the transmission, revalidation and further development of scientific knowledge in training and education, and in the enrichment of the next generation with knowledge and insight.

It can be argued that this educational function has an even broader dimension: intolerance, enmity, discrimination, xenophobia, and ethnic conflicts are often products of ignorance. Therefore the educational function also pertains to the broader community; the scientific enlightenment of the general public can be regarded as an important instrument with which to develop and strengthen the intellectual defensibility and democratic foundation of a society.

Secondly there is *instrumental* relevance, the immediate or indirect application of research through the transformation of its findings into practical tools and instruments. It cannot be denied that science has had and still has a tremendous instrumental relevance. There is no sphere or
dimension in our personal and social life that is not fundamentally affected by technology resulting from scientific research.

In the third place there is *innovative* relevance. This type of relevance refers to the contribution which scientific research can make to the creation of new knowledge and insights, which may lead to important breakthroughs in the development of industrial products, health measures, transport, communication, entertainment, and many other applications.

It should be emphasised that, while instrumental relevance is often a product of what is called applied or problem-driven research, this does not always have to be the case with respect to innovative relevance. Also pure, 'curiosity driven' research may turn out - sometimes unexpectedly and unintentionally, and even many years later - to be highly applicable. The application of polymer chemistry in plastics manufacture occurred more than 30 years after its formulation, the time lag between the development of Marconi’s telegraph and Maxwell’s groundwork on the transmission of electronic waves was more than 25 years. Many present day cardio-vascular surgical or pharmaceutical interventions result from the fundamental research of decades ago. Whatever the case, this observation justifies the importance of both applied and pure research.

The fourth form of relevance can be called *contributive* relevance. Here the aim is not instrument development or technological innovation, but rather to support or to contribute to decision-making and policy development. This can take place in the various phases of decision-making: problem definition, search for alternatives, finalisation, and implementation. The role of science is more explicit if scientific insights or research results clearly contribute to a change or continuation in policy, or if the research results are used as ammunition in a discussion or debate, either to defend or to attack a certain position or to create positive or negative attitudes with respect to a certain stance or view. The role of the scientist is rather disguised in cases where (s)he is actually one of the partners in the decision-making or policy formation process (the interactive model). The question of which role scientific insights play in the complicated and sometimes chaotic interplay of rational and irrational forces is difficult to answer. Often these insights are used for what is called conceptualisation: redefinition of the agenda, sensitisation of decision-makers with respect to certain problems, the (re)definition of problems, or the transformation of problems into non-problems.

If relevance, as is expounded in the above, is seen as a complex and multidimensional concept, any attempt to develop unidimensional measures for this relevance is doomed to failure. The European Commission's task to
assess the socio-economic relevance and impact of the research it sponsors is not only unenviable (Research Europe, 6 March 2003), but will also inevitably lead to restricted results. Monitoring tools for assessing the socio-economic effects of science, or for measuring concrete results (submitted or granted patents, spin-offs in the form of new companies, industrial growth, etc.), however useful, will only reveal part of the tale. It is important to keep this restriction in mind.

Two types of knowledge

As has become apparent in the discussion above, the roles of the scientist and the decision-maker are not always clearly distinguishable. Nevertheless, it may be wise to keep the ideal division of roles in mind. Researchers may generate information on feasibilities and impossibilities, chances and risks, direct and indirect repercussions, they can denounce stereotypes and prejudices, they can show that certain fears have no scientific or statistical justification, but they can never bear responsibility for the actual decision. They can provide evidence for the relationship between performance-related remuneration and work motivation, but they are not responsible for the level and nature of collective agreements. They can point to the evident negative relationship between smoking and health, but they are not responsible for anti-smoking legislation and rules. They can analyse the positive and negative effects of nuclear energy, but they are not held responsible for a decision to close nuclear power stations. Their trade, in short, is science and that is what they should stick to. They should not become another pressure group or seize the responsibility of politicians, employers, doctors, legislators, and educators. It would give power to the scientist who is neither trained nor competent to exert it.

But there is another complicating factor. And this has to do with the nature of knowledge and the soundness of the research on which the scientist's input is based. A distinction can be made between two sorts of contributions, depending on two disparate types of scientific knowledge:

In the first place there is solid knowledge, which is often the product of long and painstaking experimental or empirical research, and which is hardly ever the subject of disagreement and debate among scientists. We know of the effects of ultraviolet radiation on health and environment. We know of the damage which chlorofluorocarbons and carbon dioxide effluxes cause to the ozone layer. We know of the causal relationship between smoking and
cardiovascular diseases and cancer. We know of the interaction between anxiety and motivation, of the negative effects of group thinking - all examples of solid relevant knowledge. Many more examples can be given. I am not saying that utilisation is a simple matter, but the knowledge is available and only needs political transformation for use in policy decisions.

A second type of knowledge is probabilistic; it is less solid, uncertain and incomplete, and direct extrapolations are risky. Think of the prediction of a successful career, of expected returns on investments on the stock market, of the effects of atmospheric changes on the biosphere, of the long-term effects of genetic modification of plants and animals, of the strength of cultural resistance against fertility control. Numerous other examples can be given. With respect to many and often pressing questions and problems in society, our knowledge is of such nature: probabilistic, uncertain and contingent, due to either ontic (really existing in the world out there) or epistemic (insufficient and lacking knowledge) uncertainties or both. And it would be a serious mistake to communicate this 'probabilistic' knowledge to the public and to policy makers as if we were certain of the insights and conclusions. We see the negative effects if we do: confusion and suspicion at the expense of scientific research's credibility.

There is one aspect, however, that is shared by all types of knowledge and that is also a precondition for its usefulness for policy and decision-making, and that is its independent nature. The emperor Justinian did not realise that he had cut off a vital source of political life when he closed Plato's Akademeia a millennium after its founding, because its views were not in line with his own. George Bush's administration (in line with successive US administrations) does not realise how much it wrongs itself by packing advisory committees with scientists and other experts who share the administration's political outlook and have become 'all the President's yes-men'. The current US administration has so politicised the provision of scientific advice that it could permanently undermine public trust (Nature, 30-01-03). We are dealing here with an essential prerequisite for the relevance of science. Without this independence and freedom, science will sooner or later become irrelevant and useless.

Non-use

One of the major frustrations of the scientists is that his/her research results are not given proper attention. RTD Info (October 2002, no. 35) sounds a
note of disappointment regarding the relative sidelining of science during the Earth Summit in Johannesburg last year. "The scientists may have been heard but they were not really listened to. Some of the political speeches ignored or even contradicted the 'facts' now supported by an accumulating mass of evidence". The UK National Audit Office recently concluded "much of the £1.4 billion that the government spends on research each year is wasted". The chairman of the House of Commons' Public Accounts Committee pours oil on the fire by responding to the report with "research is no use at all if the policy makers do not know about it, do not understand it or need something else".

Why is scientific knowledge often ignored or neglected by politicians and decision-makers? Briefly the following reasons and motives can be brought to the fore:

- A first reason is that the research result is not believed or accepted because it is contra-intuitive or contradicts stereotypes or popular prejudices; the theoretical impossibility of the effects of homeopathy, the default of attempts to infer personality traits from handwriting, the failure to find empirical or experimental evidence for astrology, the inaccuracy of many ethnic, geographic or gender stereotypes... all these research results find it hard to replace the contrary, but persistent, prejudices.

- Secondly, research repeatedly produces contradictory results: whether there is global warming or not, whether a certain drug or treatment helps or not, whether violence on television is harmful or not... research results are available in support of either point of view. Of course, we know that science in development generates inconclusive and even contradictory research results, and that the differences can often be explained in terms of different samples, circumstances, instruments or diverging research designs, the fact of the matter is that incompatible and inconclusive research results are often a motive for the public to ignore scientists.

- In the third place, no or insufficient scientific knowledge is or has been made available in respect of many decisions. Sometimes no research has been carried out with respect to the problem in question. The scientist should be clear about this in his communication with the decision-maker. More often the results are as yet insufficiently conclusive to allow for solid advice to practitioners and politicians. To 'sell' unwarranted certainty is dangerous and may have a boomerang effect. Then we deal with probabilistic, contingent knowledge as described in the previous section. Feckless claims and unjustified certainty with respect to this type of knowledge will backfire.
as well. But users find it difficult to appreciate this type of imperfect knowledge and do not like the uncertainties that it implies.

- A fourth and most alarming cause is the observation that the scientist does not provide answers to the policy maker’s real questions. Too often his fragmented, detailed laboratory (type) studies are thought to contribute little to the understanding and handling of the complex and multifaceted reality which the decision-makers face. "Too often research and researchers seem to have little to offer on some of the key challenges we face in public policy”, and "Typically research questions as defined by those outside academia are cross-cutting: rarely can any one discipline or practitioner address it successfully....", reported The Times Higher (28 March 2003).

- A fifth motive is not a lack of understanding, but a lack of willingness. Unwillingness to accept the results of research, since these contradict one’s own preferences, ideological views or convictions. In extreme cases, the research itself is attacked or prohibited (Galileo, Spinoza), and/or the researcher is forced to comply or killed (Lysenko, More). More often attempts are made to influence the research results by suborning or threatening the researcher (a real danger with industrial or governmental contract research). But a simpler solution is, of course, to neglect the research evidence.

- A sixth reason stems from the irrefutable fact that political decision-making is more than the pure application of facts and knowledge. In a stable and comprehensive policy development and decision-making, values, norms, ethical and political considerations are important and legitimate elements in addition to the scientific and statistical facts and findings. This may assume an objectionable form if rationality is totally suppressed by power, negotiation, wheeling and dealing, personal ambitions and affinities, prospects of (re-)election, and the like. But it is, of course, perfectly justifiable to let normative, moral considerations determine an outcome that may deviate from 'scientific predictions'. Lowering the selection norms in schools for immigrants, desisting from a planned investment in a country with a repressive regime (Burma), quota systems for minorities....such decisions are acceptable to the scientific advisor if the scientific extrapolations and probabilities have been acknowledged but (with adequate arguments) 'overruled'.

A final word

Above it was argued that scientists who contribute evidence about the positive and/or negative effects of certain options should not bear the
responsibility for the actual policy making and policy decisions. They are led by scientific criteria and veracity is their main touchstone. Freedom and independence are both an important sine qua non of scientific research.

This, however, does not mean that the scientist does not bear a moral and societal responsibility. Science must concede that it is embedded in a host of ethical, social and political issues and problems that cannot be dismissed as trivial or irrelevant. Scientific activities and results are subject to ethical and political norms which have a bearing on the choice of hypotheses, the gathering of data and the conducting of experiments, and on accountability for what is ultimately done with the research data. Scientists should be aware of the dangers involved in generating knowledge that may be used in applications over which society has little control. They should also take the apprehension of the public seriously. Nature (17 July 2003), for instance, is right in arguing that we should not make the same mistake and dismiss people's fear of the harmful effects of nanoparticles as we made in respect of losing many countries' trust in genetically modified food. The challenge for science (and academies of science) is therefore not so much the choice between freedom and responsibility, but rather the attempt to find a balance between, or even to unite these two seemingly irreconcilable objectives. Freedom, therefore, is freedom in constraint. Or as Shaw observed: "freedom means responsibility, and that is why most men dread it".

Only the responsible scientist can restrain the earth from the "walk to the gallows" which Martin Rees macabrely depicts in his recent book "Our final century: will the human race survive the 21st century?" (Rees, 2003). And only the responsible scientist can denounce the cynical observation quoted in Weber (1982): The reason life is probably extinct on other planets is that their scientists were a little more advanced than ours. Let us assume this responsibility!

References


Science Communication, A Vital Necessity

*Paris, 2002*

**Introduction**

There was a time that science was studied in 'splendid isolation'. Little attention was paid to the appreciations and apprehensions of the general public. Even contact with colleagues in the rest of the world was not always optimal, as many a PhD student discovered to their dismay when it turned out that a colleague in another country had been working on the same subject and was the first to publish his or her results. This has changed drastically. Communication with colleagues has become a matter of course, and there is also an increasing need for public accountability. Scientists nowadays are confronted with a variety of social, ethical and political questions that cannot be pushed aside any longer with the argument that they are normative and not scientific. Indeed, veracity remains the touchstone of the scientist's activities, but it would be a mistake to derive from this position that they do not carry social and moral responsibility.

In this presentation we will pay attention to three categories of science communication: communication between scientists themselves, communication between scientists and the general public, and communication between scientists and interested stakeholders (industry, government, politics). We hope to demonstrate that in all three types of contact an open and fair communication is crucial for the development and acceptance of science.

**Communication between scientists**

Science has grown from an individualistic to a collective activity. It is clear that at present science cannot exist and grow in isolation, but requires cooperation, contacts and exchange of knowledge, and the opportunity to criticize, replicate or reinterpret each others' findings.

And this collaboration has, of course, to cross national borders. Throughout history scientific developments and problems never bothered about national boundaries and the international nature of science has always been apparent, but it has become particularly conspicuous in present times through

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the widespread use of fast and powerful means of communication. Also for
participants in national research programmes the need for international
cooperation is undisputable. Academies of science, and a fortiori
Associations of Academies, such as ALLEA, are pre-eminently salutary in
the process of fostering the international orientation and collaborative
activities of scientists.

This international character of science is, of course, rooted in the
universality of its laws. The universality of natural science laws can be
regarded as the fundamental advantage of science and the driving force of its
development. The laws of physics and chemistry or life sciences, often
expressed as mathematical formulas - the real scientific lingua franca - are
applicable everywhere, and scientists from all over the world can participate
in the scientific discourse. In fact, it is considered foolish for scientists not to
take part in such discussions, since this is the only way for science to
progress and for individual scientists to develop.

I would even submit that such collaboration almost always creates a better
understanding of common goals. Where there are differences in approach or
methods, collaboration will lead to a greater sensitivity to and, often, a
greater appreciation of such differences in approach. It can even contribute to
the mitigation and prevention of conflicts between nations, notably in two
ways.

In the first place by the persuasive power of scientists' belief in rationality
and rational solutions as well as by their tradition of coping with conflicts by
agreeing to the rules of rational decision making. These include a proper
definition of the question, agreement on the methods to be used, a logical
analysis of the arguments, the evaluation of the adequacy and sufficiency of
the data supporting these arguments, the resolve to collect additional
information, if necessary, and, then, to postpone definitive conclusions until
further evidence has been acquired.

A second factor that contributes to conflict resolution or prevention is the
required attitude of openness and collaboration and a need to communicate in
the search for the truth. Currently, collaboration and contacts have to cross
national borders more than ever before. Science presupposes the exchange of
knowledge, expertise and results, and requires a genuine attempt to under-
stand and criticise others' work. Even during the darkest moments of the
Cold War there was still scientific contact between the scientists of the
Soviet block and those of the Western world. I am convinced that active
dialogues between scientists of countries in conflict help to build bridges of
trust between countries.
But does this ideal of the universality of science apply to all sciences? What about the sciences in which culturally determined institutions and culturally determined behaviour are the objects of research? Two notable cases in point are the social and behavioural sciences. It is often argued that in these sciences the object of research, which is per definition determined by culture, can never be analysed by methods and conceptual systems that are independent of the culture that causes the variance in the phenomenon being researched.

I can provide a number of examples from my own research interest: cross-cultural psychology. Cross-cultural analysis of behaviour or performance in non-Western cultures often confronts the researcher with the restrictions of the theories and instruments developed in the West. There are phenomena for which no real expressions are available outside the culture concerned; for example the Japanese *ringi-sei* mode of decision making, Latin American *machismo*, or the Dutch phenomenon of the *poldermodel*. In some cultures, relationships that are considered to be generally valid are not found, such as the relationship between participation and the effectiveness of decision making, or the connection between financial incentives and work performance. It is furthermore obvious that the saliency of certain research topics is culturally determined: cultural diversity is particularly important in immigration countries, dyslexia is more relevant in literate cultures, and the issue of national versus supra-national identity more relevant in countries within the European Union. The researcher also discovers that the practicability of certain research instruments is culture-bound: paper and pencil tests cannot be used in primitive cultures, nor speeded tests in cultures where precision is more important than quantity, questionnaires in cultures where there is pressure to give socially desirable or politically correct answers, or interviews in 'face saving' cultures.

The question is, then, whether we have to understand cultural specificity against the background of universal and generic theories and methods (which is called the 'etic' approach), or whether this behaviour can only be understood within its cultural context, and therefore requires culturally specific theories and concepts (which is called the 'emic' view). In keeping with this latter view, a demand for indigenous psychologies has emerged: an African, Chinese, Indian etc. psychology besides the Western or Euramerican psychology. The examples of culturally specific topics and research instruments mentioned above encouraged some cross-cultural psychologists to support the latter approach. Many theories and methods thus
seem to be susceptible to cultural differences and to demand a cultural contextualisation.

But introducing the cultural context for a real understanding of the behaviour is not paramount to a drastic 'indigenisation' and differentiation of psychology. The need for differentiated and separate conceptual frameworks and theories for specific cultures leads to serious epistemological problems. Why, for instance, should this requirement apply only to large, well-defined cultures, and not to very specific and unique subcultures as well? Why to America versus Asia, and not to Northern versus Southern Italy or Norway, city versus countryside, men versus women, the high versus the low social economic class etc. etc.? In other words, strictly speaking the demand for continuous 'indigenisation' leads to an infinite fragmentation of psychology, and ultimately to solipsism, where nothing but silence remains. Eventually the cultural specificity can only be understood against the background of communality and the universality of theories and methods, and not vice versa. Insights that have been acquired through subjective and culturally contextualised methods always have to be verified or falsified with methods independent of the subjectivity of the observer and researcher in order to achieve a scientific character. Science requires objectivity and independence.

Finally, we may briefly pay attention to a rather recent controversial development in science communication, namely the publication of so called 'open access' journals as opposed to the traditional model, in which researchers publish their articles in journals, edited by either commercial publishers or scientific societies. As a reaction on a growing dissatisfaction with the established system, including rising subscription prices, copy right concerns, latency between finishing the research and its publication and dissemination, the open access (OA) movement is gaining ground. It propagates 'author pays' procedures and self archiving through personal websites or institutional repositories. The articles can then be accessed freely and cheaply by whoever is interested. It will be clear that current business models, on which commercial publishers as well as some learned societies rely, threaten to be subverted by this development.

Although traditional publishers have introduced various mitigating options to deal with the above mentioned criticisms, including licensing models, providing electronic versions after some time (e.g. one year), feedback services on citations, linkages with related publications, and others,
the defenders of the OA-movement want a more radical change, since they see the sharing of information as an integral part of the research. They do not see OA as a new business model, but as part of a new way of meeting teaching and research needs, treating the dissemination as integral to the academic process. In this vein the Joint Information Systems Committee (JISC) of the Higher Education Funding Councils in the UK encourages publishing in OA-journals and the creation of repositories within institutes. It also contributes to the fees that authors have to pay for publishing in OA-journals.

It has to be admitted that, if one accepts a wide, easy, sustainable and comprehensible access to research results as an important objective of science, the proposals and arguments put forward by the OA-movement cannot be pushed aside easily as idealistic and naïve. They deserve careful analysis and, if found valid, support and implementation.

**Communication with the general public**

Until a not too distant past science, as it was fashioned in the seventeenth century, enjoyed an almost matter-of-course reverence. Especially the achievements of mathematical physics and experimental medicine were accorded general respect and admiration. There was little doubt that sooner or later all secrets of nature would be unlocked and that life expectancy as well as quality of life would ameliorate markedly as a result of scientific developments. This was particularly the case since scientists, in the spirit of Bacon and Leibniz, tried to transfer some of their findings into practical technological applications.

At the end of the 20th century we see a notable swing-over of opinion. Science is not taken for granted any longer. Too often we note that the widespread public appreciation has been replaced by doubts, scepticism or even enmity. Certain media, in which admiration and respect for science used to be preponderant, give utterance to misgivings, disillusionment or even anger nowadays. In those media numerous pseudo-scientific gurus are given a wide berth to give expression to their anti-intellectual and anti-scientific sentiments, and are believed by hordes of faithful followers. These negative sentiments are partly dictated by the fact that science has eradicated much of what was dear to people: their pre-opinions, their prejudices, their espoused theories, but also their world view or sometimes even their faith. Science has robbed humanity, as Shea (1989) rightly
elucidates, of many of its illusions. Copernicus and Galileo deprived the earth of its position at the centre of the universe, Darwin denied the singular nature of the human species, Freud suggested that a human being has neither insight in nor control over his deepest motives and drives, biochemists have reduced the miracle of life to chemical processes and geneticists showed that the fusion of male and female gametes is no longer a prerequisite for human procreation.

Many of these negative attitudes and sentiments are also fed, in part, by fear; fear of a lack of control over the possible effects of scientific developments: nuclear waste, environmental deprivation, horrific consequences of genetic modification, arising dangerous viruses and bacteria, loss of liberty and privacy through ICT developments, fear, perhaps also, of a dominant scienticism and secularisation, and deprivation of religion and spirituality as its consequences.

Not all criticism is objectionable. Some of the captious questions posed to present day scientists are agreeable to reason and need careful attention. The question arises as to whether Homo Sapiens et Sciens, who has appropriated much of the divine power of the time, is sufficiently capable of handling that power in a responsible manner. Are scientists always aware of the potential and ethical consequences of their research? Do they fully realise that others, such as politicians, managers, investors, clients and ideologists may have an interest in the outcome of their research? Are scientific practitioners capable of judiciously dealing with the new-found knowledge? Have scientists sufficiently freed themselves of unwanted intrusion of influence? Have they protected research subjects against the infliction of unacceptable harm and exposure to unacceptable risks? Questions and criticisms like this cannot be arrogantly ignored by science. If not given serious attention they may erode the axiomatic quality of science and even pose a threat to science as an intellectual endeavour (Elkana, 1989). Moreover, since these attitudes may influence the general public, they may also have an unfortunate effect on the willingness of political leaders to reserve the necessary funds for innovative and frontier research.

In other words, public opinion, the sentiments of voters and the bias of the media debate largely determine the boundaries imposed on scientific practice at the beginning of the 21st century. And, as we have seen, these sentiments are unmistakably more sceptical and negative than in the past.

Important is here the honest and fair communication about results of scientific research. Some researchers focus too emphatically on the policy and practical implementations of their research, also when this is not
warranted. Other scientists give their opinion on political and social issues wrongfully suggesting that their words have a scientific justification; there may not be empirical evidence available or not at their disposal (for instance, because it is not their field of expertise). Again others claim too much success and promise too quick results, in order to acquire financial support for their research, to get public honour, or to secure an appointment or promotion. Sometimes the public is simply misled for political reasons: the general and unjustified resistance against genetically modified food, or against nuclear fission are cases in point. Scientists should never let themselves be misused for political purposes. It can be defended that wrong communication about research is always harmful. It creates too much hope (particularly in medical research), and sometimes unjust fear (technological and information developments). And, if the research results fall short and fail to accede the claims, they boomerang for science in general.

There is another problem that has to be discussed with respect to the communication of scientific results to the general public and decision-makers. With respect to many and often pressing questions and problems in society much of our knowledge is probabilistic, uncertain and contingent, because of either ontic (really existing in the world out there) or epistemic (insufficient and lacking knowledge) uncertainties or both. And it is a serious mistake to communicate this 'probabilistic' knowledge to the public and to policy makers as if we were certain about the insights and conclusions. We see the negative effects if we do: confusion and suspicion at the cost of the credibility of scientific research.

On the other hand it sometimes also reprehensible for the researchers to duck away from their responsibility and to indulge in their almost natural inclination to refrain from speaking while waiting for more conclusive evidence. Sometimes inaction is not neutral and risk-free at all. This is certainly true if we deal with irreversible effects, such as mergers of organizations, promising but risky investments, environmental problems such as global warming, the effects of CO₂ emission, etc. In other words, decision-making based on educated guesses and 'precise imprecision' is sometimes better than decision making by default or not at all.

Anyway, it has become clear that scientists must develop abilities to communicate their findings and ideas with policy makers at all levels and with the public at large. The public needs to be informed how and why their taxes are being spent. As a recent ESF report (2003) states: "Given that the public sector is the principal sponsor of research there is an increasing onus on all of us to devote more time to explaining, listening and debating". This
issue is also of great concern to Academies of Sciences and Humanities, and, for that matter, for associations of such academies, like All European Academies, ALLEA has, therefore, created a Working Group on 'Science and the Media' with the task to advise ALLEA and its member Academies on the question how to deal with this increasingly important aspect of the work of scientists and scholars: the proper communication with the general public through the various types of media, each with its own singularity and each requiring a specific approach.

Communication with stakeholders

The third category of partners in the dialogue with scientists consists of various types of stakeholders who are interested in the results of scientific research and analysis, ranging from national or regional governments to industrial companies, and from consulting firms to political pressure groups. Some of them are willing to pay for the advices or to (co-)sponsor the research, which has led to the widespread practice of contract-research at universities or research institutes.

In their advisory or decision-supporting role and in their communication with the different stakeholders the scientists should always be aware of the clear distinctiveness of scientific results and interpretations on the one hand and policy- and decision-making on the other. In the former, the principal norm is verity and the motivating force the search for the truth. Policy- and decision-makers are led by political calculations, utility, moral attitudes and value preferences. They may listen to scientists and may use their findings, but the ultimate criterion is political or economic feasibility and attainability and not veracity. Scientists can offer proper and careful analyses of the problems at hand, they can point to the (high or very low) probabilities regarding certain outcomes and risks involved, they can denounce stereotypes and prejudices, they can show that certain anxieties have no statistical justification, or that great optimism is not warranted given the available evidence, but they should not take over the responsibility from the actual decision makers, nor should they take ill of the latter for not adopting a decision or implication that the research seems to suggest. They should particularly refrain from overstressing the expected risks or benefits in order to 'convince' the politician or business man.

On the other hand we see also all too frequently that the stakeholders lose sight of this distinction. They exert pressure on scientists to set up their
research or to draw conclusions from their findings in such a way that these are in line with their interests, their hopes, or their preferences. Scientists should painstakingly take care that this infringements of independence takes place. Science cannot exist and grow without autonomy and freedom: freedom to think, to speak, to carry out research and to communicate about the findings. Only facts, and all the available facts, should speak. Only the logical, analytical norm should rule. Science should be unfettered and free from external pressures, be it from tradition, religion, ideology or political or financial interests. If science is unable to retain this independent and impartial nature, it will sooner or later become irrelevant and useless (see also Drenth, 1999).

Nevertheless, as said, this infringement of independence happens all too often. An important determinant of such attempts to influence scientists is the ideological, political or religious convictions of the (often powerful) sponsor. In history we have seen well known examples, such as Galileo, More or Lysenko. But still to day, and perhaps notably so, there are examples of the political intimidation of scientists. Hard data are difficult to find regarding how widespread this phenomenon is, particularly since the pressure can be rather subtle and unobtrusive, and since the 'victims' are not always prepared to bring it to light. But sometimes the latter do make their grievances public, and cases in point are published either in the scientific or in the popular media. Recently we could read about the complaints of the American Union of Concerned Scientists (UCS) regarding the manipulation of the process through which science enters political decisions (The Economist, 10 April 2004). Although President Bush's science advisor John Marburger has tried to rebut these claims (Nature, 428, 8 April 2004; Science, 305, 30 July 2004), many of them still prevail, one of the notorious cases being the eminent cell biologist Elizabeth Blackburn's (University of California, San Francisco) dismissal from her position on the President's Council on Bioethics, because, she claims, of her outspoken support for research on human embryonic stem cells.

I am sure all countries have their own and well known cases. In my own country, for instance, we recently had the experience of the geophysicist Berkhout, the chairman of a scientific committee that was to advise the Minister of Transport on Schiphol Airport's new noise criteria. Berkhout declared that after having been put under pressure, after having been quoted incorrectly, and after having to endure personal attacks in the media, he had decided to resign from the committee (NRC-Handelsblad, 2 December
A few years earlier Köbben and Tromp (1999) had published a number of such cases in their book titled *The unwelcome message*. Sometimes the pressure on researchers is not aimed at distortion of research results towards certain desired outcomes, but at the decision not to deal with certain subjects in the first place, so as not to run the risk of attaining certain unwelcome insights. Again, each country has its own striking examples. A ban imposed by a ‘politically correct’ university council in the 70s to prevent a criminologist (Buikhuizen) from doing research on criminal behaviour’s possible biological determinants, and the societal pressure on brain researchers to stop further research into the differences in the hypothalamus between homosexual male subjects and a non-homosexual control group (Swaab & Hofman, 1990), are cases in point in my own country. The issue has become of topical interest at present, since the threat of terrorism and national security have an effect on the freedom of universities in various countries. In the US, university officials fear that regulations controlling research, and particularly the involvement of and communication with foreign scientists and students will be further curtailed (*Science*, 304, 23 April 2004).

A special case is the restriction on research results’ publication. In principle all research carried out by publicly funded institutions (universities, research institutes) ought to be made accessible to the wider public. A clear and acceptable exception could be national security or defence interests. It is clear, however, that the extent to which these criteria are interpreted may lead to strong differences of opinion between governments and scientists, of which the present ongoing debate in the US is a good example.

A second type of determinants of the infringements have a financial/economic nature. Economic interest in research into, for instance, new medicine and pharmacology, into nano-technological developments, and into other innovative or patent-directed research can be substantial and can exert unwarranted pressure. Here, too, recent history offers a series of striking examples. *The Times Higher* of 27 April 2001 revealed that at least 19 review articles published by the highly esteemed *New England Journal of Medicine* had been written by researchers who had secret financial links to the pharmaceutical companies that had brought the examined medicines on the market. A few years ago, the *New England Journal of Medicine* described how the pharmaceutical industry lobby applied undue pressure on researchers who intended to publish data that it found unwelcome (Deyo et al., 1997). In a recent book on the perils of commercialisation, the former President of Harvard University Derek Bok (2003) expressed his belief that
the intrusion of the marketplace into the university is eroding fundamental academic values.

At this point it is appropriate to formulate a word of warning in respect of contract research at universities and research institutes that are subsidised by the government. Until a few decades ago, these institutions could almost always rely on public funding for most of their activities. Nowadays, however, they increasingly have to look for assistance from private, external funds. In principle this need not be wrong. It is quite possible for contract research to be independent and unbiased, and to be executed strictly according to the scientific rules of the game. Contract research, therefore, does not necessarily imply an encroachment on research's freedom and autonomy, but the latter can be in jeopardy if a growing proportion of a department, or institute's structural financing has to be obtained externally. After all, results that can be used to the sponsor's benefit are more likely to lead to follow-up research and new contracts than results that are disappointing. Obviously, the overriding temptation is to avoid biting the hand that feeds you.

Maybe a distinction between two different kinds of contract-research is helpful in this respect. The first has the finding of new knowledge as an objective. Of course, the sponsor does hope that this will lead to useful applications, technological innovations, or patents. But the basic objective is augmentation of knowledge. This type of contract research suits the objectives and conditions of academic research at universities or research institutes well. The only debatable point is the wish to keep the research outcomes secret so as to submit an eventual patent application. There is room for negotiation here. The basic objective of university research should be to contribute to public knowledge, therefore the research results should eventually be published, but some delay in publication can be permitted to allow for such a patent application.

Secondly, there is contract research that is prompted to legitimise a political preference or decision. In such cases, sponsors are not so much interested in the objective truth, but rather in arguments that support their view, attract votes, or can be used to oppose difficult opponents, or to answer tricky questions from stockholders. In principle there is nothing wrong with scientists who offer their service to industry, political parties, or a country's administrators, and some of this will sometimes be one-sided or biased, although such services can also be defended as mostly being the best, rendered by honest and unbiased research. Anyway, the kind of legitimising
research just described certainly does not belong at universities or research institutes where the search for 'the whole truth' should prevail.

Conclusion

We hope to have made clear that an open and truthful communication of scientists and scholars with the different dialogue partners, be they colleagues, the general public or the stakeholders who have an interest in the outcomes of research, is not only crucial for the development and acceptance of science, but also for the usefulness of science and scientific research for the society and the well being of its citizens.

References

Introduction

At present the world of science is evolving more dynamically than ever before. New fields of research are emerging, and existing fields undergo a significant deepening and widening of their conceptual and experimental foundations. And this exponential growth is not a temporary upswing, but a development that will continue to be with us in many forthcoming years.

An important question is whether Europe is sufficiently prepared and equipped to participate fully in this evolution and can compete with similar developments in other parts of the world. And we do not think only at physical equipment, infrastructure in buildings and ICT-connections, quality of management and governmental support, but also at quality of human capital and the availability of human resources. It goes without saying that, in speaking about a knowledge based society, the development and nursing of the producer and carrier of this knowledge, the scientific community, is of primordial importance. And how does Europe 'score' in this respect?

A number of years ago the European Commission published a 'green paper' on innovation (EC, 1995). This paper speaks about the 'European paradox', suggesting that in comparison with the scientific performance of its principal competitors that of the EU-states is excellent, but that over the last fifteen years its technological and commercial performance in high-technology sectors, such as electronics and information technologies, had deteriorated. The report illustrates the positive qualification of European research with output and citation scores and with numbers of scientists in Europe working in R&D as compared to other parts of the world. So Europe is good in the production of high level knowledge and bad in transforming this knowledge in useful technological applications.

But even the first part of this conclusion can be challenged. In the first place, given the timelag between sowing and reaping in science, high output and citation scores of to-day are the products of scientific investments of at least ten years ago. And some ten or fifteen years ago both the absolute and relative position of investment in science and technology in many European countries was much better (often well over 2% of GDP) than at present (1.9% of GDP for Europe in 2001). And this relative position is even

* Presented at the meeting 'Mobility of Researchers', Tallinn, Estonia, 18-20 Sept. 2002.
weakening further. In 1999 research expenditure in Europe totaled €153 billion, which is €76 billion less than in the US. Furthermore, from 1995 to 1999 the intensity of R&D expenditure has grown significantly both in the US (from 2.49% to 2.64% of GDP) and Japan (from 2.69 to 2.93% of GDP) while stagnating in Europe (from 1.89% to 1.92% of GDP) (EC Press release, 21-02-02). It will be clear that in this way the goal set in Lisbon in March 2000 by the Heads of State and Governments that the European Union should become "the most competitive and dynamic knowledge based economy in the world by 2010" will be difficult to achieve. And it is with satisfaction that the recent initiative of the Prime Ministers Blair (UK) and Kok (The Netherlands) to call for determined action by the EU and its Member States, to create a fully integrated European Research and Innovation Area and to aim at 3% of the European GDP to be spend on R&D in the year 2010, should be hailed.

In other words, the real test of the adequacy of the present investments is the output and citation performance in 2012 and further, and not that of today. Even at present we see already indications of deterioration. Tindemans and Papon (EuroScience, 2002) mention four: The relatively large number of American (based) Nobel prizes, the much higher investment of European companies in the USA than vice versa, the large number of high level European scientists that are lured away by the best American universities, and the extremely restricted brain drain from USA to Europe.

Of course, spending money in R&D is a necessary but not sufficient condition for improvement. The creation of a solid, high level, flexible and cooperative European scientific workforce and a defrayal of the dispersion and splintering of the scientific expertise are prerequisites for building a competitive Europe. In this paper we will focus on one of the salient measures in this connection: mobility of researchers, and look at its benefits and current status, and the factors that hinder its optimal realization for the present, typified by the contaminated word 'mobstacles' (mobility obstacles)).

**Mobility**

Mobility of researchers is a vital condition for the improvement of the research climate and research cooperation within Europe. The European Commission has acknowledged this and has incorporated a series of measures in its Framework Programmes to promote such a mobility. More
specifically both the financial support for the training of researchers through networks, and the Marie Curie scholarships (Individual and Return Fellowships, Industry Host Fellowships, Development Host Fellowships, Experienced Fellowships and Stays at Marie Curie Training Sites, respectively) in the 5th Framework Programme have been instrumental in this respect. To some extent this is a positive reaction on the plea of the international consultative committee on new organizational forms of graduate research training (established in 1990) for internationalization of postgraduate training in Europe (see recommendations RNAAS, 1993).

Many countries have their own mobility promoting programmes as well. In past times there has always been the attractiveness of the scientific centres in (often colonial or ruling) countries like the UK, France or Russia for students from economically less developed and third world countries. But the present mobility policy is different: the idea is that it is beneficial for researchers from any country to spend some time for study or research in another cultural environment. Many universities, Research Councils or national governmental agencies and institutes have developed an active mobility policy, to stimulate both sending and receiving foreign students and researchers. Through mailings and via the Web they actively promote this policy, as can be seen in the examples of Finland, The Netherlands and many others. Other developments take the same direction. A recent agreement on cooperation in Science, Engineering and Health between the US National Academies and the Russian Academy of Sciences (2 February 2002) includes encouragement of American and Russian specialists to apply for participation in the travel grants program administered by the National Research Council. In February of this year the European Commission also proposed to enlarge the region for its Tempus programme (at present open to countries in south eastern Europe not currently planning to join the EU, the NIS of the former Soviet Union, and Mongolia) so as to include the Mediterranean countries. Although Tempus primarily focuses on teaching growth in this programme will also extend to opportunities for researchers.

The proposals for the 6th Framework Programme are even more pertinent in furthering researcher mobility (CEC, 2001). It is defended that transnational mobility is a simple but effective and powerful means of boosting European excellence as a whole, as well as its distribution in the different regions of the EU. Financial resources are made available for universities and individual mobility, for the hosting of European and third country researchers. Financial support for the training of researchers through networks is provided for European and third country researchers for the purpose of mobility to another European or third country.
and for top class third-country researchers wishing to come to Europe, for
return to the countries and regions of origin, as well as for professional (re-)
integrating mechanisms. Also support for national or regional programmes
aiming at research mobility and for scientific prizes for excellent work
carried out by a researcher who has received EU financial support for
mobility has been budgeted. For these mobility measures, together with the
support for excellent collaborating European research teams, some 1.8 billion
Euros has been reserved.

This aspect of the FP6 proposal has met with wide approval by the
politically relevant agencies (Council of Ministers and European Parliament),
and various European advisory bodies. The European Science Foundation
(ESF, 2002) has always supported the need for mobility schemes within
Europe and made the encouragement of mobility one of the clauses in the
Foundation's own statute. The ESF stresses the importance of the continu-
ation of such schemes, but finds it necessary to develop support for mobility
at all stages in a scientific career. ALLEA (European Federation of National
Academies of Sciences and Humanities) has also expressed the need for true
and free international collaboration (2001). In fact it found the formulations
of the conditions that were used in the Explanatory Memorandum and the
proposal itself ("in some cases", "in areas of special interest") more reserved
than ALLEA considered desirable. The ESF, ALLEA and the European
University Association (EUA) have issued a joint statement on the FP6
proposals, welcoming the added support to mobility of researchers. "Human
resources and the exchange of ideas and experience are the basis for all good
research; and it is vitally important that mobility of researchers at all levels
and stages in their careers is supported and that obstacles to mobility are
removed as quickly as possible." In the political agreement reached at the
December 2001 meeting in Prague the Research Council (EU’s Research
Ministers) recalled the necessity of eliminating barriers to researcher
mobility, and reiterated its intention to eliminate these barriers. As Cordis
(Cordis Focus, nr 187, 17 December 2001) reported "The Commission was
asked to ensure that the candidate countries are clearly associated with the
conception and implementation of mobility actions, and complete an annual
report on the progress achieved on its strategy to increase the mobility of
researchers".

A last issue that deserves some attention in this respect is the question
whether the modern revolutionary developments in electronic communica-
tion with the fast e-mail and Web contacts, with video- and teleconferencing,
would not diminish the need for physical mobility of scientists. Two dis-
affirming reactions can be given on this question. In the first place it has become clear that telecommunication is not a replacement, but a complement to face-to-face contacts. Further developments in ICT will result in more distance contacts as well as more direct contacts. The reason is the importance of implicit knowledge. Many competences and types of knowledge cannot be coded and need personal contacts. The classical 'master – student' relationship will continue to be an important condition for transfer of knowledge (see WRR, 2002, p.128). In the second place it has to be admitted that particularly the poorer countries can benefit from timely communication on the newest scientific developments without having to wait for journals or reprints to arrive, or without having to spend expensive travel costs to visit scientific meetings or colleagues, but there is also another side of the story. As Arunachalam (1998) observes "technology diffuses slowly and developing countries certainly have poorer access to electronic means or getting information needed. Hardly any laboratory in the developing world has easy web access to the important databases, which means that scientists working in these laboratories never can be equal partners in the world wide enterprise of knowledge production". I suspect that the situation now (three years later) is not significantly different.

Benefits of mobility

Since almost all actors agree on the high priority that researcher mobility in Europe deserves, it may be appropriate to reflect on the reasons why. What are the benefits to be expected from this mobility? This question can be looked at from three perspectives, the individual perspective of the researcher, the perspective of the institute in which the researcher works, and the wider perspective of Europe as a whole. Let us briefly pay attention to these three perspectives.

Individual benefits

It is first and for all the individual researcher him/herself that benefits from spending some time in another research or learning environment. In the new environment he or she is often confronted with new ideas, new trends or new perspectives that may give another turn to his or her research. Not only the content and direction of research may be stimulated by such an acquaintance, also alternative contextual conditions may have a beneficial effect on the individual researcher; think of different working traditions and habits,
different decision making rules and participative styles, different methods of identifying and rewarding excellence, different ways of stimulating and utilizing creativity. Third, the salutary effect of living and working in another cultural (including language-) environment on the development of the personality, the social and linguistic skills and the expansion of the cultural horizon is difficult to overestimate.

Institutional advantages
The second beneficiary of the increased mobility is the institute, university, or research organization that sends or receives the researchers. It contributes to the knowledge transfer between universities and research institutes, it forces these institutions to strive for greater compatibility of their educational programmes and research approaches so as to facilitate the exchange of personnel, it stimulates the endeavours to enhance both the quality and transparency of the research plans and programmes, which have to be explained and justified before critical foreign visitors. And to bring in new views, new notions, and new approaches always has a refreshing effect on traditional practices, not the least in science. In fact, in the ever stronger competition for students and postdoc researchers in many European universities 'internationalisation' and 'mobility' have become increasingly explicit marketing motives. It is obviously good for PR-purposes as well.

The concept of exchange of visiting researchers is one of the building stones of collaboration. And collaboration is at the beginning of the 21st century not any more just an interesting commodity of research institutes, it is a prerequisite for growth and acknowledgement. Science has grown from an individualistic to a collective activity, requiring cooperation, contacts and exchange of knowledge, and ample opportunity to criticize or reinterpret each others' findings. And this required collaboration has, of course, to cross national borders. Although throughout history scientific developments never bothered much about national borders, and scholars like Erasmus, Descartes and Leibniz moved freely through Europe (of course eased by the fact that Latin was the one lingua franca), it has become particularly conspicuous at present, when we see almost everywhere a notable watering down of the nationalistic character of research, not the least through the widespread use of fast and powerful means of communication. For participants in research, even in so-called national research programmes, the need for international cooperation is undisputable.
Benefits for European science
A third perspective for the evaluation of mobility is that of European science as a whole. As is defended in the 6th Framework Programme promoting transnational mobility is a simple, particularly effective and powerful means of boosting European excellence as a whole (Commission of the European Communities, 2001, p.33). In the expectation of the European Commission it creates opportunities for significant improvement of the quality of the training of researchers, it promotes the circulation and exploitation of knowledge, and it helps to establish world-class centres of excellence that are attractive throughout Europe. Through the exchange itself, and the attempts to facilitate this exchange, greater compatibility of research and educational systems will be achieved, leading to a higher degree of (desirable) European harmonization of these systems. Increasing collaboration will contribute considerably to a European identity and an integrated European research community.

Also more indirect positive effects for Europe will be produced. The more integrated research community, the larger critical mass in a number of prominent research fields, and the increased opportunities for establishing world class cooperating networks will further the competitive position of Europe both in science and in the industries that lean heavily on advanced science developments (biotechnology, ICTechnology, nanotechnology a.o.). That way Europe will become a place where also top scientists from the USA and Asian countries would like to work. In addition, the greater mobility of researchers will prepare more rapidly the emergence of a true European labour market for scientists.

Mobstacles
Given these undisputable benefits the question forces itself on us why the attempts to further mobility in Europe so far have shown only a moderate success. What are the blockades and impediments for a more notable growth of mobility? The mobstacles can be classified in the following different categories:

Problems with respect to compatibility
One of the objectives of mobility is to further compatibility and harmonization of the European education and research systems. The lack of this compatibility is, somewhat paradoxically, one of the very reasons why mobility is difficult to realize. Educational programmes and requirements,
even in the same disciplines, vary greatly in Europe. The same is true for degrees and certificates. Degrees in one country are often not accepted in another and there is a poor tradition of transnational recognition of diplomas and certificates.

Fortunately some trends for a change in this diversity and incompatibility in European Higher Education become visible. On May 25, 1998 four Ministers of Education (of France, Germany, Italy and the United Kingdom) signed the Sorbonne Declaration on harmonization of architecture of the European higher education system. This was followed by the so-called Bologna declaration, adopted on 19 June 1999 by 29 European Ministers of Education, aiming at (a) the development of a system of recognizable and comparable diplomas and degrees, (b) a generally accepted two phase-system, leading to a Bachelors and a Masters degree respectively, possibly followed by a Doctors degree, and (c) the creation of a system of generally accepted credits, which is expected to promote mobility. On May 19, 2001 32 European Ministers of Education met in Prague and reaffirmed their commitment to the objective of establishing the European Higher Education Area by the year 2010, in which most of the goals set in Bologna should be achieved. The Ministers emphasized that the objective of the mobility of students, teachers, researchers and administrative staff as set out in the Bologna declaration is of the utmost importance. They confirmed, therefore, their commitment to pursue the removal of all obstacles to the free movement of all four categories of individuals, endorsing strongly the Mobility Action Plan accepted by the European Council in Nice in 2000.

It is debatable whether the language differences in European education and research can be considered as mobstacles that have to be removed in order to promote mobility. There is little doubt that language difficulties are an important factor in the stiff progress in mobility. *Nature* (vol. 415, 28 February 2002) quoted German researchers in saying that language is a factor indeed in the relatively small percentage (only 10%) of the 2080 Marie Curie fellowships awarded between 1999 and 2001 that were used to study at a German university or research institute. Voices can be heard that defend the return to one scientific lingua franca, as we had Latin in the old days. And it needs little imagination to conclude that that lingua would be English. Personally I am not so sure that that would be an ideal solution. First of all language differences are part of Europe's cultural diversity and richness, rather than an impediment, and I would hesitate to take measures which would impoverish these languages, which certainly will be the case if scientific communication and writing in that language would stop or be
discouraged. Secondly we would often loose the richness of our ideas and messages if we have to formulate all our thoughts in English. Concepts and connotations are sometimes idiosyncratically connected to the original language, and lose their subtleness in a translation. Thirdly I am not so sure that being taught by a teacher who cannot use his native language but has to communicate in what often is just 'broken English' is such a rich blessing.

Mobstacles that have a formal/legal character

Many difficulties and obstacles have to do with formal rules and regulations, including unfavourable tax regulations, bad or non-existing social security systems, rigid superannuation and state pension schemes, difficulties with visa and working permits, problems with the distinction between stagiaires, PhD students, postdoc workers and regular researchers or teachers, difficulties with respect to immigration policies, employment regulations, scholarship systems, etcetera. In The Netherlands it is required to request a working permit each time a foreign researcher wants to spend some time at one of the Dutch laboratories or universities, and this permit is refused if the employer has not advertised widely in Dutch media the 'vacancy' in which such a foreign guest is to be appointed, and no Dutch candidate has been found suitable. Unjustly the foreign 'knowledge worker' is seen as any other worker on the labour market, and not as a carrier of unique knowledge.

Some have accused also the 'Brussels bureaucracy' of creating unnecessary thresholds. The forms to be filled in and the payment and reporting procedures are considered cumbersome and deterring. But I do not find this criticism justified. If one looks at the TMR Marie Curie payment and reporting procedures (see for instance www.cordis.lu/tmr/src/mcdocs.htm) one cannot maintain that these procedures are unnecessarily complicated or superfluous. Moreover, a comparative glossary of conditionals in legal English, German, and French is produced, which includes an analysis of the properties of phrases used in the different languages, so as to give a more accurate translation of legal documents (Research Europe, 7 March 2002); a laudable initiative.

In a number of cases individual countries are making an effort already to meet with several of these difficulties. Information offices are established in major foreign countries, flyers, information bulletins and websites are produced by universities and institutes, working groups are formed to deal with the problems (e.g. the NUFFIC working group 'Mobstacles' in the Netherlands, Nuffic, 2002) and conferences are organized for exchange of experiences and information on procedures. On January 29 of this year the
Academy of Arts and Sciences, the National Research Council and the Association of Universities in The Netherlands jointly made a plea for simplification of admission procedures and the authorization of (accredited) universities and research institutes to handle their own admission procedures (scientific visa).

But it is here that the European Commission or the European Council really can make a difference, if they want to take mobility of students and researchers seriously. The Bologna and Prague declarations are hopeful signs in this respect and the EU and Council of Europe should be held accountable for the implementations. In this connection also the suggestion of Kordon, prepared for a EuroScience workshop (EuroScience, 2002) is worth studying. This proposal contains the definition of a Statute of Young Scientists in Europe, which should be made available (say 5 years) for young scientists and engineers engaging in European or Europe sponsored research task forces. During its term of validity the statute should supersede national labour rules, but ensure eligibility of its beneficiaries to at least social security benefits and pension rights.

**Encumbrances related to personal circumstances**

In the third place numerous personal circumstances may hinder the opportunity to travel abroad for an extended period of time. Of course, these can be manifold ranging from family responsibility to financial or health constraints.

Two specific factors have to be listed here. In the first place the increasingly important needs and ambitions of the researcher's partner. This problem is not specific for the scientists, also embassy personnel and employees of multinational companies often face the same difficulty in their career planning. Nowadays more often the partner has an own career, which will interfere with the mobility plans, certainly if periods of more than one year are considered. Some multinational firms try to develop dual career counselling: both for the employee and his or her partner.

A second problem relates to the question what happens upon return at the home institute. Not only should the post be held open, also the regular career prospects of the candidate should not suffer; on the contrary, the (successful) experience abroad should be rewarded and be seen as a positive contribution to one's career. Too often, however, this is not the case. Sometimes the position is occupied, and, in addition to the fact that foreign degrees are not fully recognized, the candidate continues his or her career with an handicap rather than with an advantage. This is why the inclusion into the 6FP
fellowships of schemes to aid return and re-integration of researchers deserves our full support.

**Brain drain?**

Finally a word on a serious consequence that mobility might have, namely the chance that a visiting researcher will stay in the visited country, either on his or her own initiative, or because he or she is invited to apply for a vacant function at the host institute or is offered an attractive job in industry. If this takes place at a fairly large scale we speak of ‘brain drain’.

Particularly several Central and Eastern European countries are easy victims of this phenomenon. The status of academic research in these countries has deteriorated sometimes dramatically by lack of funding for research, poor facilities and low salaries. We see that many youngsters who go for training to the USA or to a European country cannot resist the temptation to stay there for longer term employment if offered such a chance. This is equally if not more the case with students from Asian and African countries. Of the 33.000 Chinese students enrolled in graduate programmes in 1999 almost 90% said that they planned to stay in the US (*Nature*, 13 June 2002).

At present the Central and Eastern European countries themselves also acknowledge this as a problem. In March of this year the Russian President Putin responded to the mounting complaints about the deplorable state of Russian science by establishing a new grant scheme for 600 young scientists and their supervisors, to be selected through competition. At the Bonn conference on 'European enlargement: new opportunities for research funding' on March 7, 2002 the Polish Academician Siemaszko requested that the EU’s structural funds also be used to improve research infrastructure, in order to strengthen the innovation basis and attractiveness for young researchers to stay in the country.

Of course, more financial support, higher salaries and better infrastructure are laudable measures to defy danger signs of brain drain in the countries under consideration, but at the same time they lower mobility. The same is true for the sympathetic proposal of Kordon for scholarships for young and promising scientists in Central European countries in their institutions of origin instead of in Western countries (EuroScience, 2002).

If we want to promote mobility we may have to accept the higher chance of researchers staying in the country they visit. It is not easy to counter this tendency and may be a price we have to pay, although it has to be said that
not every science politicist considers it a dramatically bad thing (see for instance the remarks of Nobert Kroo (secretary general of the Hungarian academy of sciences) as quoted in Cordis Focus, nr. 193). One could hope that the phenomenon is only temporary, and that in better times the drain will be reversed. In fact, we do see examples of a brain gain in countries where governments and industry have made a real effort to improve the conditions for R&D. Finland (the highest percentage of GDP to be spent on R&D in Europe) and Ireland (see the recent initiatives of the Science Foundation Ireland and the Higher Education Authority) are clear cases in point. Also the UK has seen a 'positive balance' of 5000 last year, due to the financial efforts of the UK government, as reported by Prime Minister Blair in his speech 'Science matters' at the Royal Society in London a few months ago.

Secondly, the idea of earmarking (parts of) mobility scholarship for use after return to the home country, as is proposed within the FP6 and strongly supported by ESF, has to be encouraged. In fact, FP6 will introduce reintegration grants for researchers returning to all EU countries or associated states, while the present FP5 saw only return salary costs fellowships for researchers returning to the Community's less favoured regions.

Thirdly, also more flexible use of the funds partly in the home- and partly in the visited institution will help. But real improvement can only be expected if general rules of temporary and semi-temporary residence, admission and employment regulations, rules of permission to return later and to move more easily across nations for scientists and scholars will be alleviated. Only then mobility will truly advance. One would hope that eventually this could be realized internationally across the globe. But let us make a solid start in Europe!

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**Growing Anti-intellectualism in Europe: A Menace to Science**

*Bratislava, 2003*

**Introduction**

Until a not too distant past science, as it was fashioned in the seventeenth century, enjoyed an almost matter-of-course reverence. Especially the achievements of mathematical physics and experimental medicine were accorded general respect and admiration. There was little doubt that sooner or later all secrets of nature would be unlocked and that life expectancy as well as quality of life would ameliorate markedly as a result of scientific developments. This was particularly the case since scientists, in the spirit of Bacon and Leibniz, tried to transfer some of their findings into practical technological applications.

At the end of the 20th century we see a notable swing-over of opinion. Science is not taken for granted any longer. Too often we note that the widespread public appreciation has been replaced by doubts, scepticism or even enmity. Certain media, in which admiration and respect for science used to be preponderant, give utterance to misgivings, disillusionment or even anger nowadays. In those media numerous pseudo-scientific gurus are given a wide berth to give expression to their anti-intellectual and anti-scientific sentiments, and are believed by hordes faithful followers.

Partly these negative sentiments are dictated by the fact that science has eradicated much of what was dear to people: their preopinions, their prejudices, their spouse theories, but also their world view or sometimes even their faith. Science has robbed humanity, as Shea (1989) rightly elucidates, of many of its illusions. Copernicus and Gallileo deprived the earth of its position at the centre of the universe, Darwin denied the singular nature of the human species, Freud suggested that a human being has neither insight in nor control over his deepest motives and drives, biochemists have reduced the miracle of life to chemical processes and geneticists showed that the fusion of male and female gametes is no longer a prerequisite for human procreation.

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* Some of the thoughts expressed in this article were formulated earlier in a paper presented at the 10th European Sceptics Congress in Prague, 7-9 Sept., 2001.
Many of these negative attitudes and sentiments are fed, in part, also by fear; fear for lack of control over the possible effects of scientific developments: nuclear waste, environmental deprivation, horrific consequences of genetic modification, arising dangerous viruses and bacteria, loss of liberty and privacy through ICT developments, fear, perhaps also, for a dominant scienticism and secularisation, and deprivation of religion and spirituality as its consequences.

Not all criticism is objectionable. Some of the captious questions posed to the present day scientists are agreeable to reason and need careful attention. The question arises whether Homo Sapiens et Sciens, who has appropriated much of the divine power of the time, is sufficiently capable of handling that power in a responsible manner. Are scientists always aware of the potential and ethical consequences of their research? Do they fully realise that others, such as politicians, managers, investors, clients and ideologists may have an interest in the outcome of their research? Are scientific practitioners capable of dealing judiciously with the new-found knowledge? Have scientists sufficiently freed themselves of unwanted intrusion of influence? Have they protected research subjects against the infliction of unacceptable harm and exposure to unacceptable risks? Questions and criticisms like this cannot be arrogantly ignored by science. If not given serious attention they may erode the axiomatic quality of science and even pose a threat to science as an intellectual endeavour (Elkana, 1989). Moreover, since these attitudes may influence the general public, they may also have an unfortunate effect on the willingness of the political leaders to reserve the necessary funds for innovative and frontier research.

In other words, public opinion, the sentiments of voters and the bias of the media debate largely determine the boundaries imposed on scientific practice at the beginning of the 21st century. And, as we have seen, these sentiments are unmistakably more sceptical and negative than in the past. It seems prudent, therefore, to take a moment for a closer examination of this critical attitude of the public and the media.

**Public scepticism and criticism**

We may distinguish three forms of opposition or criticism in discussing society's critical attitudes towards science: anti-science, para-science and pseudo-science.
Anti-science is the most negative. It goes beyond claiming that science has failed to produce any salutary results or benefits, holding instead that it is the root of much trouble and a catalyst for disaster. In this view science is held responsible for gross inequalities in wealth and poverty in the world, for global pollution, for amoral consumerism, for giving rise to new diseases and genetic aberrations, and it is seen as a threat to economic balance, international justice and peace. Science painted as the villain of the piece. References are made to Lombroso, Mengele and the eugenic movement, deterrent stories are told (and with pictures illustrated) about headless frogs and mice with human ears, and about a world with an unimpeded practice of human cloning. In these stories the scientist is often depicted as an irresponsible and ruthless Mephisto or Frankenstein.

A long time science has brushed aside these anti-science sentiments as products of frustration or irrational anxiety. But since these anti-science noises can be heard more frequently nowadays, and from time to time are mixed with justified questions on the social and ethical responsibilities of the scientist, such a neglect may be harmful for integer science indeed.

Less directly aggressive towards science but in the long run equally dangerous are the effects of these sceptical attitudes on the development of a large variety of para- and pseudo-scientific theories and approaches. Particularly the sciences that deal with very personal and existential needs (well-being, health, understanding), including medicine, psychiatry and psychology, have been a victim of such deviations from the classical, accepted scientific traditions. In the following we will pay special attention to the para- and pseudo-scientific excrescencies in the behavioural sciences, but we are convinced that much of the reasoning given in this context is generalisable to many other disciplines as well.

Para-science is not in itself anti-scientific, but claims that scientific knowledge is insufficient for proper and full insight in human behaviour, and that additional paths have to be walked for its real understanding. Since science is not expected to amount too much a plethora of alternative solutions are offered, including esoteric methods, psychic media, telepathy, listening to voices for instance from space, clairvoyance, tarot reading and others. The therapies or treatments connected with these approaches often flirt with equally esoteric, occult or paranormal practices: faith healing, reincarnation, healing by laying hands on a patient, hypnosis and others. Often these methods are but one small step away from the spoon benders, horse whisperers and finger-tip surgeons. The line between genuine ignorance and fraud is often terribly vague.
We are not speaking of a rarity in the present New Age era. A number of para-scientific beliefs and movements have accumulated a fairly sizeable following. A survey among Newsweek readers a few years ago revealed that almost 50% of the respondents believed in the existence of UFO’s, and that some 30% believed in the existence of aliens. A more modest survey among students at my own university some years ago revealed that one third trusted that memories of past lives can be triggered under hypnosis, that two thirds accepted the predictive value of dreams, and that a quarter believed in psychokinesis. And since the collapse of the Communist ideology in Central and Eastern Europe the popularity of para-science there is raising alarmingly. Is it that the abjuration of the repressive regime has opened the door for a false conception of freedom, in the sense that ‘everything goes’ and that rational discipline is no longer needful?

One may wonder why and how these unlikely and illogical views and claims so often are accepted and believed. Evidence and arguments for the contrary do not seem to have much effect. Even remarkable testimonies to the harmfulness of some of these ideas and practices do not undermine the maintenance of these beliefs. Dawes (2001) has made an interesting distinction in this respect. Lack of supporting evidence, even evidence for the opposite or outright contradictions are only important for people that (like to) think coherently and rationally, which takes time and effort. Unfortunately many people think in the intuitive mode, which is swift, effortless and associative. This is then further reinforced by five of the ‘seven sins of memory’ (Schacter, 2001), transience (forgetting things), misattribution (mixing aspects of memory), suggestibility, bias and persistency (perseverant memories of traumatic events). Dawes believes in educating people to become more rational thinkers, since he is convinced that the world would be a better place if we made the effort to think rationally and coherently.

Pseudo-science looks somewhat like para-science, but distinguishes itself by the intention to appear scientific. Pseudo-scientists flirt with scientific terms and concepts, write articles and books in a scientific fashion and with a scientific pretention, and suggest that they want to take part in the scientific debate. Often they have special training schools or give special courses, they award titles and certificates to their graduates, albeit outside mainstream academia.
Behavioural pseudo-science

Three types of pseudo-scientific manifestations in behavioural sciences can be distinguished: Pseudo-scientific theories, pseudo-scientific diagnostics, and pseudo-scientific treatment/therapy. In the following we will pay some attention and give some examples of all three types of behavioural pseudo-science (part of the following has been discussed also in Drenth, 1999).

Pseudo-scientific theories

Pseudo-scientific theories consist of sometimes very elaborate conceptual constructions, but often built upon one or two basic assumptions or beliefs that are unverifiable: belief in reincarnation (reincarnationism), belief in the existence of aliens, angels or devils, or a personal God that influence human behaviour and affect destinies (theories adhered in certain sects or religions), the influence of the positions of stars and planets at the very moment of birth (astrology), the idea that mental power can influence the location and movement of physical objects or processes (psychokinesis), or the idea that simultaneous developments in quite different areas can be explained as expressions of one common principle (metabletica). Some of these theories are fantastic and imaginary, sometimes bizarre and eccentric, often also fascinating and gripping, as Van Boxsel (2001) demonstrates in what he describes as morosophy (foolish wisdom, or wise foolishness). Some of these theories go way out, such as the world peace mathematics, the pneumatic-energetic monism, interastral communism, spiritual intelligence, and the theory of Bach-numbers. Others are less harmless, since they are used to explain, predict and control human behaviour. Reincarnationism and astrology are certainly among the most well known examples of these dangerous convictions.

Such theories, however, are always scientifically delusive, since they are basically unfalsifiable. Again, in the case of exotic morosophic fictions no harm is done; it is even an intellectual challenge to try to counteract some of the sometimes ingenious argumentations. But in case these theories are used as a basis for psychological explanation and are applied to influence people and to affect their lives, the situation is different, and it is here that the unfalsifiable assumptions come home to roost. Of course, one can try to falsify some of the predictions made on the basis of the theory (which has been done for example with respect to reincarnationism, and astrology), but falsification is never accepted as disqualification of the theoretical presuppositions. Invalidating evidence is always explained in terms of measurement.
faults, sampling errors or predominance of other factors in the complex system of behavioural determinants. It is never the default of the theory. This is why it is always a discouraging endeavour to get engaged in a scientific debate with defenders of these theories. They always flutter away and evade the real argumentation.

**Pseudo-scientific diagnose**

Here we are at the territory of fictitious psychodiagnostic analyses of human behaviour. And the examples in psychology are abundant. A great many invalid and defective instruments and methods have been and are used in a non-professional context, and, unfortunately, in professional psychological practices as well. But we have to make a distinction between psychodiagnostic applications that do not meet the generally received psychometric standards and pseudo-scientific psychodiagnosics.

The first category refers to practices in which tests or other diagnostic instruments are used that have not demonstrated satisfactory reliability and validity, both prerequisites for responsible application. In an adequately reliable test the results are not influenced too much by chance factors; the test is a sufficiently consistent measuring staff. A test is sufficiently valid if there is enough empirical evidence for two claims: firstly that it measures the capacity or personality trait which it is supposed to measure (construct validity), and secondly that it predicts with reasonably certainty future performance or behaviour of the tested individual (predictive validity). Unfortunately too many instruments and tests are used for descriptive or predictive purposes without measuring up to these two criteria. Personality questionnaires and scales, interviews, performance tests, lie detectors, observation tests, even regular intelligence and achievement tests are used without sufficient warrant that the psychometric and validity standards have been met. But this should not be considered as pseudo-scientific diagnosis, rather as substandard performance of psychologists. Both psychometric amelioration of the instruments and better training and increased responsibility of test users could lead to an improvement of this malpractice.

Pseudo-scientific diagnosis makes use of diagnostic instruments or methods that suffer from principal defects or shortcomings, that are based on unscientific, erroneous or sometimes even preposterous presumptions. Some of them were once popular, but are not taken seriously any longer. Examples are the Szonditest, Koch's Baumtest, the Pfister colour pyramid test, Lüscher's Colour test, frenology. Others are incidental trials, one-day flies, or eccentric beliefs outside the mainstream (e.g. Penn colour system, naildiagnostics or
the Figure Preference Test). Again others, just as ludicrous as the tests listed above, are still used widely. Examples are the Rorschach Inkblot test, Draw a Person (DAP) and other expression techniques, among which in particular graphology, still popular among others in Germany, Israel, France, Switzerland, and parts of the USA. Time will not permit me to demonstrate the unscientific basis of these tests and projective techniques, and the reader has to be referred to the critical literature on these instruments (Jackson & Messick, 1967, Drenth & Sijtsma, 1990). But I may bring to the fore graphology as a prototype of the pseudo-scientific diagnostic methodology.

Graphology is distinct from handwriting-expertise. The latter is a method to compare pieces of written text in order to establish identity or non-identity of the writers, and which has an accepted evidential value in court. Graphology starts from the assumption that given characteristics of handwriting can be identified reliably and have diagnostic meaning if properly interpreted. Graphology is therefore a putative method of personality assessment. In that sense it can be compared with and falls under the same scientific rules as other assessment measures. But it is here that graphologists and experimental psychologists diverge. Repeatedly it has been shown that graphology cannot substantiate its claims, and that its predictions about human behaviour and performance are so little different from chance distributions that its use as selection-instrument or as psychodiagnosticum is certainly not warranted (see for instance Jansen, 1974). But graphologists ignore these conclusions, base their claims on personal experience, on casuistry, on analogy argumentations (large writing: a person with grandeur, angular writing: abrupt manners), on generalizations of impressions (sloppy writing indicates a chaotic personality, 'controlled' and tight writing refers to a rigid, constricted, possibly even compulsary personality), or on reference to an in those circles authoritative school of thought, which has been powerful, but lacks any empirical test or validation. Particularly the German characterologist Klages has been influential in this respect with his theory about the opposition of the cognitive mind and the feeling heart (der Geist als Widersache der Seele). Any expression (also in handwriting) is a reflection of the balance between these two powers and the diagnostician has to disentangle the underlying forces. In another leading school of thought the Swiss graphologist Pulver propagates the use of space symbolism. The top zone in written letters represents the intellectual and transcendent spheres, the middle zone the personal, regulating forces, and the lower zone the animal, material nature. The (emphasis on the) left reflects the past, the ego, the introvert side, and the (emphasis on the) right the other, the future and the
extravert part. Look here, the elements for an imaginative interpretation are on hand.

What makes this diagnostic tradition pseudo-scientific is the lack of experimental verification, even the lack of the need for such scientific control on the one hand, but extensive flirtations with psychological and philosophical theories and traditions and a quasi-scientific packing of the message on the other.

Pseudo-scientific treatment and therapy

In the therapeutic garden a host of pseudo-scientific horsefeathers can be found, ranging from hypnosis to healing by prayer, from reincarnation therapy to scientology, and from neuro-emotional integration to homeopathy. Again, time does not permit us to give a full and critical account of all these therapeutic approaches. Moreover, since time and again new therapeutic movements come to the fore, it is difficult to keep full record of these developments.

But in our analysis we have to be careful. Unlike diagnosis, prediction of human performance or behaviour, and assessment, therapy is not a (applied) scientific activity. Criterion for therapeutic activity is effectiveness, not verity; at stake is not whether it is true, but whether it works. We all know that credibleness of the therapist and faith being put in the therapist are equally or sometimes more important than the quality of the treatment or the medicine as such. We also know that placebos work if brought with cogency and that spiritual healing or a magic word of an overbearing guru may cure even somatic diseases.

This is not to say that these types of healing are not without danger. In the first place we see often a more serious relapse after a temporary improvement, as was shown by the psychologist Vervaet in a follow-up study of patients healed by praying. Moreover, in case of no or little success victims suffer not only from feelings of disappointment but also from feelings of guilt and failure (insufficient motivation of faith). Third it prohibits serious investigation and diagnostics with once and again tragic consequences.

But what brings some of these therapeutic approaches into the category of pseudo-science is the claim that their presumptions are predicated on scientific understanding and scientific evidence. Often we see that these therapies are presented and justified by such scientific pretentions. Again, I will illustrate this by discussing a fairly recent and popular movement known by the name NLP, an acronym which stands for neuro-linguistic
programming (see also Drenth, 1999). NLP was presented by Bandler and Grindler in their *Frogs into Princes* (1979), and elaborated for instance in Adler's *The New Art and Science of Getting What You Want* (1994). The 'edifice' is grounded on a few truisms: emotions and motivations affect the body ('neuro'), people often mean something different from what they say ('linguistic'), and setting a goal and believing in it helps achieving this goal ('programming'). Then they take off. With rich phantasy concepts and relationships are introduced (engrammes, nominations, perception types) and conclusions drawn (on emotions, on creativity, on left or right brain dominance) which lack each theoretical or experimental basis. The psycholinguist Levelt (1995) passed devastating judgment on NLP: It is not informed about the literature, it starts from insights that have been rendered out of date long ago, concepts are not apprehended or are a mere fabrication, conclusions are based upon wrong presumptions. NLP theory and practice have nothing to do with neuroscientific insights, nor with linguistics, nor with informatics and theory of programming. NLP is not interested in the question as to how neurological processes take place, neither in serious research.

The question rises: Why is it still so popular? Why do people pay for the expensive courses and consulting? Why its popularity in (even respected) companies, as well as in educational and orthopedagogical circles? In the first place it is a shrewd commercial formula and marketing. Then there are the flirtations with science (the name NLP, the 'masters degrees', the 'scientific' books). But as soon as NLP is seriously challenged scientifically we see sham manoeuvres: "we are interested in another kind of truth", "something can be true even without scientific proof", "it is self evident", "clients are happy and satisfied". With these argumentations swindle is defended and people are made to believe that the moon is made of green cheese. Mundus vult decipi, ergo decipiatur.

**Why psychology?**

Finally, an interesting question is: why is pseudo-scientific moonshine so popular notably in psychology and psychiatry? Let me briefly offer a few suggestions:

- Pseudo-scientific psychology hitches into the (sometimes desperate) need of people with psychological problems: neurotic, anxious, depressive, or
phobic patients, that are despondent at the end of regular and unsuccessful treatments, often take anything for granted.

- Confusion of object and method. Psychology deals with phenomena that are often not (yet) understood and cannot (yet) be explained: dreams, phantasies, anxieties, déjà-vu’s, telepathic experiences and others. One is too easily persuaded to accept that these phenomena can never be clarified via normal scientific reasoning, and that ‘new’ and ‘creative’ methods are needed.

- Pseudo-scientific movements often make use of social psychological mechanisms, such as the need for belonging, group think, ingroup - outgroup controversy. Critics are silenced with the retort that one must be part of the movement to make a sound judgment. Lack of criticism is further enhanced by features reminiscent of new religions: gurus, rituals, incantations, and inaccessibility.

- Founding theories and visions were once popular and accepted, but new scientific research has demonstrated their untenability; however, adepts still cherish the idols and adhere the outdated ideas. This may explain the tenacity of the conjectures about the relationship between physical and mental characteristics, location of capacities and traits in the brains, Jung's typology, the temperament cube of Heymans, the inkblot method of Rorschach, and many other illusions that are for instance described in Kouwer (1963).

- Economic motives. Often pseudo-scientific practices are motivated by loathsome pursuit of gain. We have already seen the economic manipulation of the credulity of NLP-quarries. Graphologists offer their services to organizations and individuals, and quite a few of them are making a good living. Well known is the financial exploitation of the victims of scientology, avantar and similar movements: mundus vult decipi, even if - or, paradoxically, because - it requires financial sacrifices.

A final word

Whatever its causes, there is no doubt that the pseudo-scientific fiction in psychology and psychiatry is able to develop and flourish in the room created by the anti-scientific sentiments of the present Zeitgeist. The dwindling appreciation of science should, therefore, be a major concern for scientists and scientific institutions at the beginning of the 21st century.
References


Die Digitale Revolution in der Wissenschaft: 
‘A Mixed Blessing’

Heidelberg, 2001

Vorbemerkung

Es ist mir eine Freude und eine große Ehre, an diesem Ort heute vor Ihnen sprechen zu dürfen. Als Sitz einer altehrwürdigen und renommierten Universität und einer hochangesehenen Akademie der Wissenschaften ist Heidelberg über Jahrhunderte hinweg ein bedeutsames Zentrum für Kultur und Wissenschaft gewesen, wenn auch vielleicht für die meisten reformierten (kalvinistischen) Jugendlichen in meinem Land, wegen der Erinnerung an die mühsamen Versuche in der wöchentlichen Sonntagschule, den Heidelberger Katechismus auswendig zu lernen, die Assoziation mit Heidelberg keine unmittelbare Freude auslöst.

Ich möchte mich heute mit der jüngsten Revolution in der Welt der Information und Kommunikation, als Folge des explosiven Wachstums des elektronischen Instrumentariums, auseinandersetzen sowie mit den Auswirkungen dieser Entwicklungen auf die Wissenschaft. Dass diese Entwicklungen positive Auswirkungen hatten und noch haben, brauche ich nicht darzulegen: Sie haben zu einem ungeahnten Wachstum der Möglichkeiten der Datensammlung und -analyse und einer unvergleichen Intensivierung der Kommunikation mit Fachkollegen auf der ganzen Welt geführt und werden weiterhin dazu führen. Im Titel meines Vortrags spreche ich jedoch von ‘a mixed blessing’. Damit will ich angeben, dass die Folgen der digitalen Revolution nicht ausschließlich segensreich sind und dass damit auch potentielle Gefahren verbunden sind; Einwände, die uns veranlassen, nicht alles, was auf diesem Gebiet auf uns zukommt, mit offenen Armen zu empfangen, und die uns zwingen, uns auf unerwünschte Folgen vorzubereiten, die sich über kurz oder lang einstellen können.

Die dritte Welle: `a blessing'


Eines der Gebiete, auf denen die Entwicklungen der Informations- und Kommunikationstechnologie sich in besonderem Maße geltend machen, ist das der Forschung. Faktisch gehörten die Wissenschaftler zu den ersten, die die Möglichkeiten der neu entwickelten Technologie zu benutzen verstanden. World Wide Web wurde vor etwa zwölf Jahren im Laboratorium von CERN in Genf entwickelt, ursprünglich mit dem Ziel, die Kommunikation innerhalb der Teilchenphysik zu erleichtern und zu verbessern; aber sie breitete sich schon bald auf vergleichbare Anwendungen in anderen (Teilgebieten der) Naturwissenschaften und den Sozialwissenschaften aus sowie (mit einiger Verzögerung) den Geisteswissenschaften. Internet hat sich inzwischen von einem einfachen Informations-Transport-Netz, das nur Zahlen und einfachen
Text enthielt, zu einem äußerst avancierten System der Übermittlung von Datenbanken entwickelt, mit reichgestaffelten Texten und Abbildungen, die einer großen Zahl von Kunden der verschiedensten Art zur Verfügung gestellt werden. Es werden gegenwärtig Informationssysteme entwickelt, die Multimedia- und Videotechniken verwenden, deren Ziel ein System ist, "that allows users access to all the information they need, when and where they need it" (EC, 1999, S. 30).

Wie gesagt, durch diese 'dritte Welle' überstürzten sich die Entwicklungen in so gut wie allen Wissenschaftsgebieten. Ohne diese Entwicklungen wären zum Beispiel
- die Erfolge in der Entschlüsselung des menschlichen Genoms nicht so schnell, wenn überhaupt, erzielt worden,
- zahllose segensreiche diagnostische, therapeutische und präventive Mittel im Gesundheitswesen (noch) nicht verfügbar,
- Voraussagen und somit notwendige Korrekturen auf dem Gebiet von 'global change' nicht möglich geworden,
- viele der zahlreichen komplexen Modelle in Physik und Chemie, die unentbehrlich sind, um das Verständnis naturwissenschaftlicher Phänomene zu vertiefen, nicht entwickelt worden,
- Mikroelektronik und Nanotechnologie in den Kinderschuhen stecken geblieben,
- hätten Forschung und Theoriebildung im Hinblick auf die neuro- und hirnfysiologischen Grundlagen der Sprachentwicklung und der kognitiven Funktionen stagniert,
- wären ökonomische Simulationen und Modelle, die zum Verstehen der immer komplizierter werdenden ökonomischen Prozesse auf Makro- und Mikroniveau unentbehrlich sind viel zu simplifizierend geblieben,
- vergleichende Studien in Sprach- und Literaturwissenschaften, Archäologie und Kunstgeschichte nicht in so großem Maßstab möglich gewesen.

Soweit zu der These, dass eigentlich jeder Wissenschaftszweig in hohem Maße von den Möglichkeiten profitiert hat, die die Entwicklungen in der modernen Elektronik und der Computertechnologie boten.

Dabei muss festgestellt werden, dass die Wissenschaft nicht nur von diesen Entwicklungen stark beeinflusst ist, sondern dass sie diese selbst auch initiiert und gefördert hat. Die Forschungen auf dem Gebiet der Computertechnologie und der Informationswissenschaft haben zu einer Vielzahl von innovativen und fruchtbaren Initiativen geführt. Zu erwähnen sind Entwicklungen sowohl in Hardware-Technologie (Verbesserungen von

Bei der Frage, wie die Forschung auch in Zukunft von den fortschreitenden Entwicklungen profitieren kann, ist auf jeden Fall an die folgenden Möglichkeiten zu denken:

1. die zunehmende Kapazität in der Verarbeitung sehr großer Datenmengen, wodurch Daten neuer, sehr komplexer Systeme synchron oder diachron gesammelt und bearbeitet werden können,
2. die zunehmende Befähigung, sehr komplexe Datenbestände zu integrieren, wodurch Möglichkeiten geschaffen werden, wissenschaftliche Phänomene zu analysieren, die seither als zu schwierig und zu kompliziert galten,  
3. die Entwicklung heuristischer Systeme und kreativer Algorithmen, wodurch neue wissenschaftliche Fragen und Problemstellungen aufgeworfen werden können,
4. verbesserter Zugang zu seltenen oder einmaligen Daten und Quellen, wodurch Wissenschaftler, wo auch immer auf dieser Welt und zu welchem Zeitpunkt auch immer, sich dieser Daten für ihre Forschungen bedienen können,
5. Erleichterung der Möglichkeit, wissenschaftliche Expertise von überall her zu einem Forschungsvorhaben heranzuziehen, um eine optimale Zusammenarbeit zu gewährleisten und eine Vernetzung zu erreichen, 
6. die Entwicklung neuer Instrumente auf dem Gebiet der Kommunikations- und Informationsbeherrschung, um Forschungsergebnisse optimal zur Verfügung zu stellen und eine schnelle und breite Zugänglichkeit wissenschaftlicher Information zu gewährleisten (elektronisch Veröffentlichen, elektronisch Archivieren, digitale Bibliotheken, digitale Arbeitsgemeinschaften und virtuelle Netzwerke), 
7. die Weiterentwicklung von ´distributed computing’, wobei multiple Computer und Netzwerksysteme miteinander verbunden sind und die Datenverarbeitung über verschiedene Partizipanten verteilt ist. Via ´distributed com-
puting' können neue Gruppen von Benutzern und von Entwicklern als zusätzliche Hilfsquellen in derartige miteinander verbundene Systeme aufgenommen und herangezogen werden.


**Praktisch-technische Probleme**


Zuerst muss gesagt werden, dass beim Veröffentlichen von Forschungs-ergebnissen der Beurteilungsprozess den größten Aufwand erfordert, und das wollen die Wissenschaftler ja im allgemeinen nicht aufgeben; sie wollen die Zuverlässigkeit des Publizierten doch nicht in Frage stellen! Des Weiteren ist es zweifelhaft, ob elektronisch Publizieren tatsächlich so viel billiger ist,
umso mehr, wenn man die Zeit, die Redakteure und Gutachter darauf verwenden, miteinbezieht. Auch ist es fraglich, ob elektronische Information auch weiterhin gratis verfügbar bleibt; bereits jetzt kennen wir Beispiele für `pay per view', und die werden sicherlich zunehmen. Schließlich werden (zumindest vorläufig) praktische Probleme, die auf mangelnde Kompatibilität, Standardisierung und Zugänglichkeit zurückzuführen sind, weiterhin den elektronischen Leser frustrieren und die optimale Kommunikation behindern.

Für die digitale Bibliothek gelten viele dieser Probleme (Zugang, Kompatibilität, Kosten) genauso. Dazu kommt noch, dass eine elektronische Bibliothek ihre technischen Anlagen fortlaufend aktualisieren (`update') muss. Das führt dazu, dass unabhängig Anpassungen und Änderungen der Benutzerprozeduren erforderlich sind; eine große Schwäche des Systems, da der Benutzer diesen Veränderungen nicht immer folgen kann und sich enttäuscht abwendet.


**Philosophische und erkenntnistheoretische Probleme**

In diesem Abschnitt werden, manchmal in Frageform, eine Reihe von Einwänden eher wissenschaftstheoretischer Art besprochen.

Eine erste Frage, die sich stellt, ist die: Welche Auswirkung haben die elektronische Verarbeitung und Kommunikation auf die Art der 'wahren' Erkenntnis? Tun wir unserer Erkenntnis nicht Gewalt an, indem wir sie in den Panzer der Kommunizierbarkeit via elektronische Medien pressen wollen? Und verbauen wir nicht den Weg zu bestimmten Entwicklungen und Entdeckungen, wenn wir die Forderung nach elektronischer Kommunizierbarkeit an die erste Stelle setzen?

Zum zweiten: Beeinflussen die von der Informationstechnologie bestimmten Methoden der Datensammlung und -analyse nicht die wissenschaftlichen Hypothesen und Theorien selbst? Wird zum Beispiel Wissenschaft dann nicht eher die Verarbeitung ungeheuerer Datenmengen als die Suche nach Erkenntnis und tieferem Verständnis, oder auch eine eher kollektive als individuelle Angelegenheit? Ist dem durchschnittlichen Forscher noch deutlich, was geschieht, wenn er oder sie ein SPSS-Paket mobilisiert, um bestimmte Datenbearbeitungen vorzunehmen? Besteht nicht auch die Gefahr, dass wissenschaftliche Theorien eher überzeugen, wenn sie von großen Datenbeständen unterstützt werden, als wenn sie auf einem kritischen Urteil beruhen?

Ein wichtiger Grundsatz im wissenschaftlichen Verkehr ist Vertrauen. Der Leser muss sich auf die Glaubwürdigkeit und die Qualität der übermittelten Information verlassen können. Und das wird so langsam ein heikler Punkt bei der elektronischen Art des Publizierens. Die Urheberschaft ist oft undeutlich, und die Definition dessen, was ein Aufsatz ist, ist vage. Wir
werden mit Vorabdrucken, 'grauer' Literatur und Versuchen aller Art überspült. Dazu kommt noch, dass oft auch die Daten selbst direkt zur Verfügung stehen und von anderen als dem Verfasser selbst bearbeitet werden können, was dann wieder in den ursprünglichen Aufsatz aufgenommen werden kann, mit oder ohne Zustimmung oder gar Mitwissen des eigentlichen Autors. Traditionsgemäß gab es immer die Unterscheidung in Daten (im Laboratorium oder im Notizbuch), Information (in Zeitschriften und Büchern) und Wissen (bei der Person des Forschers). Diese Art der Unterscheidung verschwindet nach und nach. Der Unterschied zwischen Daten und Information, zwischen formeller und informeller Kommunikation oder zwischen einem Brief und einer Veröffentlichung gerät durch die Einführung von e-mail und Internet ins Wanken, was zu dem Ruf nach einer Neudefinierung dieser Kategorien der Informationsübermittlung führt. "The blurring of traditional divisions is a key factor in the transfer of information from traditional to electronic channels", so schreibt Meadows (1990, S.37).


In mehr allgemeinem Sinn muss man sich überlegen, welchen Einfluss der elektronische Verkehr auf unser Bild von der Welt hat und auf den Begriffsapparat, mit dem wir dieses Bild versuchen zu erfassen. Vielleicht müssen Begriffe wie Privatsphäre, Geheimhaltung, Demokratie, persönliche
Identität usw. eines Tages neu definiert werden. Eine interessante Frage ist auch, welchen Einfluss die Dominanz der Computerwelt auf die Vorstellungen unserer Kinder hat, die damit bereits aufgewachsen. Wie gehen sie zum Beispiel mit der zunehmenden Verwischung der Grenze zwischen virtueller und reeller Wirklichkeit um? Hat Chester recht mit seiner Behauptung in dem UNISACT-Bericht (1998), dass das Spielen in der virtuellen Realität, in der Handlungen keine wirklichen Folgen haben, die Fähigkeit untergräbt, gut und böse zu unterscheiden, und dass dies bei Jugendlichen weittragende Folgen haben könnte?

Sozial-politische Probleme

Fast jeder erfährt am eigenen Leibe, was für tiefgreifende Veränderungen im sozialen und interaktiven Verhalten des Menschen die elektronische Kommunikation mit sich bringt. Interaktionen werden sowohl enger (da sie elektronisch determiniert sind) als auch breiter (international, 'hyperlinks', 'cyberspace'). Auch das Leben des Wissenschaftlers wird davon beeinflusst. Kürzlich hörte ich einen Kollegen klagen, dass er engeren Kontakt mit seinen superspezialisierten Kollegen in Berkeley und Ann Arbor habe als mit seinen Kollegen am selben Flur. Manche sehen dies als einen Gewinn, aber die Frage ist doch, ob hier nicht Wertvolles verloren geht.


Zum Schluss: Was hier als ein intranationaler Einwand dargelegt wurde, könnte möglicherweise noch stärker gelten in einer internationalen Perspektive. Die Frage erhebt sich, ob die `digital divide' zwischen `have' und `have nots' innerhalb einer Gesellschaft sich nicht auch zwischen den Ländern der Welt geltend macht. Und dann denken wir natürlich insbesondere an die Benachteiligung der ökonomisch weniger entwickelten Länder. Die Sache hat übrigens zwei Seiten: Einerseits kann man den Standpunkt vertreten, dass informationstechnologische Entwicklungen für ökonomisch weniger entwickelte Länder ein Segen sind, da Forscher in diesen Ländern nun einen gleichrangigen und schnellen Zugang zu wissenschaftlichen Entwicklungen haben und nicht mehr angewiesen sind auf teure Zeitschriften und Bücher, noch auf weite und kostspielige Reisen, um Forscherkollegen oder wissenschaftliche Zusammenkünfte zu besuchen. Andere sind weniger optimistisch. So äußerte sich der indische Mathematiker Arunachalam in einer Internetmitteilung noch vor wenigen Jahren: "Technology diffuses slowly and developing countries certainly have poorer access to electronic means of getting information needed. Hardly any laboratory in the developing world has webb access to the important data bases, which means that scientists working in these laboratories never can be equal partners in the world wide enterprise of knowledge production". Zusammen mit der Tatsache, dass Wissenschaftler aus Entwicklungsländern noch immer größere Probleme haben beim Publizieren in elektronischen Zeitschriften und der Tatsache, dass auch Herausgeber von Zeitschriften viel weniger dazu neigen, Forscher aus diesen Ländern als Referent heranzuziehen, wird dies, Arunachalam zufolge, die Kluft zwischen diesen und den westlichen Ländern eher vergrößern als verringern. Das wiederum wird den Brain-Drain weiter ermutigen und Abhängigkeit dieser Länder von der Hilfe des Westens vergrößern.

Schlussfolgerung

In diesem Vortrag habe ich versucht aufzuzeigen, dass die Entwicklungen der modernen Informations- und Kommunikationstechnologien für die
Ich danke für Ihre Aufmerksamkeit.

Literatur

The Relevance of Social and Behavioural Sciences for Policy Making

Beijing, 2000 *

Introduction

The 20th century witnessed the birth and development of a great number of behavioural and social sciences: psychology, sociology, anthropology, demography, political science, educational science, paedagogics and many others. The pioneers in these new sciences were almost without exception optimists: better insight in individual behaviour, in relations and interactions of people, in societal structures and processes would have to lead to a better world, was a leading thought. It strongly motivated these scientists to explore the determinants, the stimulating and inhibiting factors of human behaviour, as well as the social, cultural and political context of that behaviour.

We are now some hundred years out and have become sadder and wiser: we see more personal and group conflicts than ever; wars, military conflicts, ethnic emulations fill our TV-screen almost daily; stress, anxieties and depressions are clearly on the increase; aggression and criminality are becoming a nightmare for governments and citizens. In the past century about 200 million people have been killed by the orders of rulers in power. The Swedish medical scientist Diczfalusy (1999) dismally summarizes which detestable aspects of human nature he has experienced and witnessed in his long life: "aggression, barbarity, terror, cruelty, hypocrisy, naked cynism, moral and intellectual corruption and, the worst of all, indifference". The psychologist Frijda (1992) tempered the ambitions of psychology in his valedictory address in which he searched for an answer to the question of the usefulness of psychology: "The world does not become better with psychology, it does become worse without: more stupid, more vulgar and more susceptical to tyranny." So there is some hope?

Relevance

At stake is the issue of the 'relevance of (social and behavioural) sciences'. This issue has been subject of extensive discussions in the Western world during past decades, especially since the neo-Marxist ideologists in the 70's propagated that relevance was equal to the extent to which sciences (and in particular the social sciences) contributed to the emancipation of the lower classes, to the redistribution of power in organizations and to the general ideals of equality and a free and democratic society. Much of the more recent political debate on the appropriatedness of scientific research and, more important, on the justification for its funding is rooted in a quite different definition of relevance, namely as the contribution to economic growth and technological development. Utility of science as paramount to its capacity to stimulate the growth of the gross national product! Then there is relevance as seen in the eye of a professional practicioner in simple instrumental terms: the extent to which science can help to develop powerful drugs against diseases, to construct effective learning devices, to help to build strong dikes and bridges, or to help to market products or services. Clearly, relevance and usefulness of science may have many different faces, may refer to many different goals, and may be defined differently by various users. It may be appropriate at this point to elaborate a bit on this concept. I would like to propose a distinction between three types of relevance:

In the first place intrinsic relevance, which goes beyond the economic value and practical applicability. Research, be it in the natural sciences, in the humanities or in the social sciences, leads to an augmentation of the body of knowledge, an intrinsically valuable and precious quality of civilization. Raising questions on the nature of matter, the origin of the earth, the essentiality of love, the laws of logic, the learning of language, but also on the significance of life, the goal of human existence, and the meaning of death.....is a fundamental and unique characteristic of the human species and a motor for its development.

It is clear that the continuity of this scientific discourse appears to full advantage in dialogue with the next generation. In other words, intrinsic relevance is strongly related to the educational mission of science: the transmission, revalidation and further development of scientific knowledge in training and education, and the enrichment of the next generation with knowledge and insight.

Certainly for the social and behavioural sciences this educational function has an even broader dimension: intolerance, extremism, repression, xenopho-
bia, and ethnic conflicts are often a product of ignorance. Therefore, the educational function also pertains to the broader community; the scientific enlightenment of the general public can be seen as an important instrument to develop and to strengthen the intellectual defensibility and democratic foundation of a society.

Secondly there is instrumental relevance, the immediate or indirect application of research through the transformation of its findings into practical tools and instruments. In the first place one may think of the development of useful instruments, systems, drugs, aids and appliances. Social science and especially behavioural science research has resulted in an abundance of these devices and techniques: tests, learning devices, therapeutic or prophylactic drugs, perception aids, but also means to influence people, to support decision making and to direct or change societal systems. Secondly, somewhat less directly technological, but still falling within this functional definition of relevance, is the contribution which scientific research can make to the development or creation of new knowledge, which may lead to important breakthroughs in preventive of therapeutic approaches, in intervention practices, or in ways to influence developmental societal processes. Freud's psychoanalysis, Bandura's social learning theory, Lewin's field theory, Kluckhohn's study of culture, Coser's analysis of social conflicts or Elias' explanation of civilization are just a few cases in point.

It should be emphasized here that, while this instrumental relevance is often a product of what is called applied or problem driven research, this certainly is not always the case. Also pure, 'curiosity driven' research may turn out - sometimes unexpectedly and unintendedly, and sometimes even many years later - to be highly relevant. A few illustrations from the hard sciences: the development of computer tomography based on the at the time 60 years old Radon theory, the application of polymer chemistry in plastics manufacture 40 years after its formulation, and the development of Marconi's telegraph some 30 years after Maxwell's grounding work on the transmission of electronic waves.

A third form of relevance can be called contributive relevance. Here the aim is not instrument development or direct problem solving with the use of social or behavioural science research, as was the case with instrumental relevance, but rather the support or contribution to decision making, policy development or taking a stand. The visibility of this contribution and the involvement of the scientist can vary from almost untraceable to explicitly recognizable (see for instance Weiss, 1977). An example of the first extreme
is the so called interactive model, in which the scientist him- or herself is one of the partners in the decision-making or policy-formation process. The question which role the scientific insights play in such a complicated and sometimes chaotic interplay of rational and irrational forces is difficult to answer. Often these insights are used for what Weiss calls conceptualisation: redefinition of the agenda, sensitisation of decision makers with respect to certain problems, the (re) definition of problems, or the transformation of problems in non-problems.

A second form of contributive relevance is the use of research results as ammunition in a political debate, either to defend or attack a certain position, or to create positive or negative attitudes with respect to a certain stance or view. In my country I see research results being brought to the fore in the political discussion on the reformation of the secondary school system, on the socialization of immigrants, on the tolerability of violence and sex on television, and on the acceptability of advertisement of tobacco products. Here the scientist has to be very careful: the arguments are being used by government, opposition, activists, and interested parties and are therefore vulnerable: bias, misleading interpretations, large generalizations or sheer incorrectness are rather rule than exception.

On the other hand we see forms of contributive relevance of research, in which the role and contribution is clear and explicit. Think of the political or organizational decision making, in which the scientific researcher can be consulted in different phases. In the first, initiating phase, research may help to define the problem about which a decision should be made. Research often brings to the surface unsatisfactory procedures, dissatisfaction of employees, risky and dangerous production processes, harmful living conditions, injustice or discrimination in the treatment of citizens, and the like. In the second phase, the search for alternatives, research results can be used to estimate the chances of success and the unwanted side effects of the various options under consideration. In the third phase, the finalization of the decision making, the researcher can assist the decision maker by calculating or estimating the (financial or other) consequences of proposed amendments or combinations of options. In the fourth phase, the implementation, the researcher can assist by identifying possible impediments or resistance to change, as well as by administering follow up and evaluation research.

In this last case the roles and responsibilities are clear. Scientific researchers generate information about feasibilities and impossibilities, chances and risks, direct and indirect repercussions, but they are not responsible for the decision itself. They can point to the evident relationship
between smoking and the occurrence of cancer and heart diseases, but they are not responsible for anti-smoking legislation. They can show that there is a negative relationship between family income and family size as well as between education and population growth in developing countries, but they cannot decide on the magnitude of the governmental aid and development programmes in these countries.

Non-use

Two types of possible frustrations with respect to the application of social and behavioural scientific research can be distinguished: misuse of science and non-use of science. We start with the latter. Why is scientific knowledge often ignored or neglected by decision makers? A number of possible reasons and motives can be brought to the fore:
- The research result is not believed or accepted, since it is contra-intuitive or in contradiction with stereotypes or popular prejudices; the inadequacy of the interview as a means of selection, the deficiency of homeopathy, the default of attempts to infer personality traits from handwriting, the failures to find empirical or experimental evidence for psychokinesis, astrology, reincarnation,... all these research results find it hard to replace the contrary, but persistent stereotypes.
- A second reason is that social and behavioural research repeatedly produces contradictory results: whether participation does or does not lead to better production, whether class room populations in schools should be homogeneous or heterogeneous, whether pornographic movies further or subdue sexual aggressiveness, whether or not death penalty leads to lower crime rates,... often research results are available in support of either point of view. Of course, this can be due to different samples, circumstances, instruments or to the research design, fact of the matter is that all too often research results are anything but compatible and conclusive.
- In the third place the researchers themselves are to be blamed. They often do not make sufficient distinction between research results and their personal opinions and normative views. Time and again we see a scientist or scholar in a scientific programme on television or in the newspaper not presenting scientific analyses or results, but only moral, pragmatic or political opinions. Then one cannot blame the politicians or the general public that they neither take these scientists seriously when they do come up with solid research! Of
course, also the scientist is entitled to have and to express personal opinions, but rather not under a scientific flag.

- A special handicap for the social and behavioural sciences is that they often have to compete with all sorts of pseudo-scientific 'experts', who offer scientifically furbished nonsense. I mentioned already a few above: astrology, kinesiology, graphology, neuro-linguistic-programming, reincarnation and many others. How can the general public distinguish the corn from the chaff?

- A fifth and legitimate factor is the fact that decision making is more than the pure application of facts and knowledge. This may turn out to become objectionable when rationality is totally suppressed by power, negotiation, dealing and wheedling, personal ambitions and affinities, prospects for (re-)election, and the like. But it has also a positive side. Even if research results and scientific evidence do play a role in a majority of decisions, it is ultimately a complex of normative, moral, ideological and political considerations that determine the outcome. And that can deviate from the 'scientific predictions'. Lowering the selection norms in companies for immigrants, desisting from a plan to invest in a country with a repressive regime (Burma), quota systems for minorities, abandoning the decision to close down a department .... such decisions should be acceptable for the scientific advisor if the scientific extrapolations and probabilities are acknowledged but (with arguments) 'overruled'.

- A sixth motive is not lack of understanding but lack of willingness. Unwillingness to accept the results of research, since these contradict own preferences, ideological views or convictions. In extreme cases the research itself is attacked or prohibited (Gallileo, Spinoza), and the researcher is forced to comply or killed (Lysenko, More). More often attempts are made to influence the research results by suborning or threatening the researcher (a not imaginary danger with industrial or governmental contract research). But the simplest solution is, of course, to neglect the research evidence.

- A final reason is that for many decisions simply no or insufficient scientific knowledge is or has been made available. Sometimes no research has been carried out with respect to the problem in question. More often the results are inconsistent, preliminary and insufficiently conclusive to allow for solid advices to politicians and practitioners. Here we encounter a difficulty that particularly pertains to the social and behavioural sciences. We have to admit that the type of knowledge in these sciences is to quite an extent incomplete, probabilistic and contingent, and that direct extrapolations are full of risks. Renewable and other alternative energy sources will be made available, but
to what extent will they be used and at what price? Education and empowerment of women will decrease fertility, but how strong is the traditional and cultural resistance against such changes in certain regions? Knowledge and information lower anxiety and hostility within the general public, but what is the best way to reach this public?

Given the uncertain and contingent character of our knowledge, is it wise to communicate this to the policy and decision makers? and if so, in what form? I would like to stress three things with respect to providing uncertain and probabilistic knowledge to policy making: In the first place it is important to clearly indicate the probabilistic character of the scientific conclusions, and, if possible, the precise margins of imprecision. Secondly, as in all probabilistic research, chances and consequences of two types of mistakes should be spelled out: positive and negative errors. The former refers to the incorrect acceptance of hypotheses, and the latter to the incorrect rejection of hypotheses. Both types of faults may occur, and the seriousness of the impact of both faults should be assessed. Such information may strongly contribute to the quality of the decisions made. In the third place, much of the conclusions from this type of research should be moulded in the form of 'if....then' sequences. Many scientific conclusions have a conditional character; they are contingent upon certain events, conditions, contexts. Systematic 'if....then' analyses with respect to likely outcomes will often provide helpful information to the decision maker. In fact, this is what takes place in a more elaborate form in the popular technique of building future scenarios.

**Misuse**

In a way abuse of scientific results is even worse than non-use. There is always the danger that the scientific knowledge is being misused. Decision and policy makers may use the data and conclusions selectively, they may add a biased interpretation or extrapolate the conclusions to decisions and policy in a totally unwarranted manner. The dissolution of the 'headstart' programme by the Californian state government on the basis of Jensens study into the (un)trainability of intelligence, and the use of results of genetic personality research by the eugenetic movement are repugnant examples.

There has been a time that de scientific researcher just did research and was not much concerned about what happened with his or her results. That was not his or her responsibility. Science was about the question how things
are, and not how things should be. Moral and ethical questions regarding the use of scientific research could be posed, but not to him or her.

At present this attitude, which, by the way, has been already rare within the social and behavioural sciences, has been generally abandoned. It has become clear and accepted that the responsibility of the researcher does not stop at the door of his laboratory or research institute. Misuse of research results certainly is the researcher’s concern. It cannot always be prevented, but at least the researcher - after completing and publishing the research - can be expected to:
- promote and take active part in the discourse on ethical and social consequences of scientific research and its implementations;
- be on the alert for selective and biased interpretations of the research findings, and depreciate such interpretation;
- be observant of possible improper use or abuse of the research findings, warn against such abuse and take corrective actions;
- accept the responsibility to provide careful, complete and understandable information on research, including in popular media, particularly if probabilities of a substantial political, social or economic impact are high;
- educate and train students and professionals in developing conscientious attitudes and scrupulous rules of behaviour in applying research findings in their professional work.

**Conclusion: freedom and responsibility**

Let me by way of conclusion ask attention for the fundamental dilemma, which was already briefly touched in the previous section. Science and scientists - and certainly social and behavioural scientists - operate in a field of tension with two poles: freedom and responsibility. On the one hand science cannot exist and grow without freedom. Scientific practice is unconceivable without the freedom to think, to speak, to research and to communicate about this research. Only the facts, and all facts, should speak; only the analytical, logical norm should rule. Science should be absolutely free of tradition, ideology, religion, and political or financial external pressure. If science is unable to retain its independent, impartial and unaffiliated nature, it will sooner or later become irrelevant and useless.

On the other hand there is, as indicated before, the necessity and need for public accountability. Scientists are confronted with a great number of ethical, social and political questions which cannot be pushed aside with the
argument that these questions are normative and not scientific. Ethical and socio-political questions arise with respect to the choice (or non-choice) of a research subject, to the nature of data collection and experimentation, and to the question what will be done with the research results afterwards.

As far as this responsibility is concerned one should not think immediately of moratoria ('no go' or 'slow go' decisions). This avenue is fraught with danger. Throughout history examples abound where science has been repressed because its results did not favour with ruling ideologists or clergymen, or did not serve the interests of the economic or political authorities, or pressure groups. One should rather think of own norms and constraints of the scientist, such as the following:

- research is not justifiable if unacceptable damage is inflicted upon the object of research: be it a human being, animal, nature, culture, or social system;
- research is not justifiable if it is in conflict with basic human values, including in any case: human dignity, solidarity with mankind and responsibility for sustained development of a planet that has to be left to future generations.

References

Mr. Chairman, Ladies and Gentlemen,

It is a great pleasure for me to speak at this occasion and to express sympathy to the objectives of this meeting on behalf of the Academies of Sciences and Humanities in Europe. I would like to congratulate the Refugee Education and Training Advisory Service (RETAS, UK), the University Assistance Fund (UAF, NL) and the Belgian umbrella organization Overleg Centrum voor Integratie Vluchtelingen, and to compliment them with the executive responsibility for the wider partnership of refugee agencies in 14 EU member states, in order to unlock educational and labour market opportunities for the extensive refugee’s potential in Europe.

I think I owe you an explanation as to why a President of the European Federation of Academies of Sciences and Humanities addresses this audience today. The fact that this President has been the Chairman of the UAF-Board for more than ten years may be an inducement, but is not a sufficient motive.

Let me explain what my organization is and where it stands for, and clarify why it makes sense for it to give moral support to the present initiative. As said, ALLEA is the European Federation of National Academies of Sciences and Humanities. National Academies and Scholarly Societies represent the intellectual communities of countries around the world. These Academies are looked to for advice, leadership and the advancement of knowledge. Their members are leading experts in the sciences, medicine, engineering, law and social sciences and the arts and humanities.

ALLEA was created when new opportunities for cooperation arose in the 90’s due to the end of the cold war and the increasing significance of supranational gremia (EU, European organizations and institutions) in the area of science and higher education became clear. It has members from all over Europe, from Iceland to the Georgian Republic, from within the European Union and beyond.

Not all ALLEA’s members are alike qua structure, mission and roles. But in spite of the differences Academies have one important objective in common: the desire to promote and to develop top scientific and scholarly...
research. They aim at this goal both because they believe in the intrinsic value of scientific knowledge, and because they are convinced that proper scientific research is indispensable for the development of societies and the well being of mankind.

In recent years more than ever scientists (and Academies of Sciences) realise that they live in a field of tension; tension between freedom and responsibility. True, scientific practice is unconceivable without the freedom to think, to speak, to carry out and to communicate on research. If science is unable to retain its independent and impartial nature, it will sooner or later become irrelevant and useless. But at the same time there is the - in recent years increasing - need for public accountability. Scientists nowadays are confronted with a variety of ethical, social and political questions that cannot be pushed aside with the argument that they are normative and not scientific. The challenge for scientists and Academies of science is therefore not to make a choice, but to find a balance between these two conditions freedom and responsibility. These two objectives are nicely phrased in the 1996 Genoa Declaration on Science and Society, which reads as follows:

- "Respect for the diversity of cultures within societies and promotion of science as a distinctive and important contributor to bridging such diverse cultures and promoting peaceful coexistence in accord with the principles of freedom, autonomy and rationality.
- Mutual cooperation, reflecting the recognition that the production and utilization of scientific and technological knowledge are decisive for the future welfare of humanity and that science, with its universality, is uniquely positioned to serve a better future in accord with the principles of responsibility, solidarity and respect for the rights of individuals and nations."

In this vein - and here I come to the first justification of ALLEA's interest in FREE - academies in Europe (and in the rest of the world) have become active and have provided leadership in human rights, among others through the International Human Rights Network of Academies and Scholarly Societies. This Network was created to address grave issues of science and human rights throughout the world. It aims to put into practice the professional duty of scientists and scholars to assist those colleagues whose human rights have been, or are threatened to be, infringed and to promote and protect the independence of academies and scholarly societies worldwide. The basis of the Network's activities is the Universal Declaration of Human Rights.

As was formulated in a recent memorandum of the Network Executive Committee, the Network seeks to promote the free exchange of ideas and
opinions among scientists and scholars in all countries and, thereby, to stimulate the development of collaborative educational, research and human rights endeavours within academies and universities and research institutes with which they are affiliated. Any hindrance of or moratorium on scientific exchanges based on nationality, race, sex, language, religion, opinion, etc., thwart the Network’s goals and should be opposed. Such moratoria and hindrances would deny colleagues their rights to freedom of opinion and expression, interfere with their ability to exercise their bona fide academic freedoms, inhibit the free circulation of scientists and scientific ideas, and impose unjust punishment. They would also be an impediment to the instrumental role played by scientists and scholars in the promotion of peace and human rights.

Many scientists and scholars, who have become a victim of repression and persecution solely for having non-violently exercised their rights as promulgated by the Universal Declaration of Human Rights, have been given support through official protests and pressures to discharge, sometimes with success (Examples in Iran, Iraq, Egypt, Sudan, China, Soviet Union).

I see no reason why this solidarity and support should not be extended to potential scientists and scholars, as students, certainly graduate students, are. I asked the Steering Committee of ALLEA to signify its adhesion to the principles and objectives of FREE, which it wholeheartedly did. This is the first justification of my addressing you this morning with plights of support and sympathy.

But there is a second, more pragmatic argument, which relates to the present state of the art in European science. We see two somewhat contradictory developments. On the one hand there is the ambition for Europe to become the most dynamic and competitive knowledge based economy in the world by 2010 (as stated at the Lisbon Summit, March 23, 2000) and the objective to raise the percentage of European GDP to be spent on R&D from the present 1.9% to 3% by the year 2010. On the other hand there are signs of further deterioration of an already gloomy picture of the European state of affairs in science: look at the relatively large number of American (based) Nobel prizes, look at the much higher investment figures of European companies in the USA than vice versa, look at the large number of high level European scientists that are lured away by the best American universities, and the highly restricted brain drain from the UAS to Europe.

Measures should be taken to reduce this trend. Moreover, there is an additional problem: in a recent letter to the European Commissioner Philippe Busquin ALLEA shared his grave concern about the declining attractiveness
of natural sciences and engineering among students and young researchers in many European nations. Great pains should be taken to stem this unfortunate development. The measures and strategies to be considered include raising interest in science at an earlier stage of development, the stimulation of more women to pursue a career in science, an increased flexibility and mobility of researchers and students, the stimulation of flexible retirement, increasing investment in infrastructure, more room for basic science driven research and paying more attention to questions of public and social responsibility of scientists. But one of the more prominent proposals for improvement is the suggestion to increase the (possibly temporary) immigration and mobility from outside Europe, in particular from Asian and third world countries, by removing the many formal, legal and informal obstacles that frustrate an optimal inflow of non-European science students and scientists at present.

At this point we are at the centre of the second justification of our interest in FREE. If one looks at the group of refugees, many of which are students or students in spe, what does one observe? The following conclusions are based on my experience and research with Dutch refugee students, but I see no reason why these could not be generalised to other European countries. We see:

- A strong representation of the age range 19-30 years. So we are dealing with people in their prime age and at the beginning of a potentially long working career.
- An overrepresentation of highly educated individuals, which is not surprising: captious intellectuals and critical students are the natural enemies of dictators. Freedom of thinking, speech and writing is the greatest threat for dogmatic ideologists and religious fundamentalism.
- Refugees show a more than average level of determination and motivation. They had the guts to exchange hearth and home for another country, a different culture and an uncertain future.
- More than average interest in the natural sciences and engineering; a very important observation in view of the above mentioned low interest in these subjects.
- Some of the refugee students break off their study for good reasons: they find a promising job after a few years of study, or they return to an improved situation in their country of origin. But among those who remained student we were able to establish a success rate, both in terms of quality of examinations and number of years to complete the study, equal to or at certain points even better than the average Dutch students at the universities or polytechnics.
What I am saying is that the Dutch higher education and scientific institutions should welcome this substantial extension of the scientific and technical potential in our country. It could mean an important contribution to the impending problem of lacking scientific human resources. This, no doubt, is even more true with respect to the greater Europe.

Of course, refugees often also keep their cultural traditions, habits and approaches to work. But, given the increased diversification of the national populations and the internationalisation of markets and clients, such a greater diversity is an asset rather than an impediment, which should be welcomed rather than feared.

For these two solid reasons, Mr. Chairman, I am happy to be able to witness the start of a European Fund for Refugee Employment and Education, and I am glad to give this initiative the full blessing of the European Academies of Sciences and Humanities. I wish them lots of luck and success.
Regional Scientific Collaboration in Europe: Opportunities and Challenges

Budva, 2004

Science and the role of Academies

Recently I presented a paper at the World Science Forum in Budapest with the title 'Science, does it matter?'. I started by quoting Lee Ray who had said that the general public has long been divided into two parts: those who think science can do anything, and those who are afraid it will. The relevance of modern science for society and societal development seems palpable to either side. In a 2003 issue of *Le Monde*, Henry Audier (CNRS) warned that if Europe wants to preserve its role in tomorrow’s world, it must redirect its priorities towards education, culture and research. In the same issue, the Nobel laureate Francois Jacob noted that the power of nations had long been measured by the size of their armies; today it is rated by their scientific potential. Such messages help drive us, academies, to reinforce the centrality and salience of science in modern times.

I am addressing you as President of All European Academies (ALLEA), the European Federation of National Academies of Sciences and Humanities. Our members form quite a multifarious conglomerate. Some academies include only the natural and life sciences; others only the humanities and social sciences; many, indeed most, include both. Some academies restrict themselves to organizing meetings and debates, while others also have a very important advisory role vis-à-vis government. Some member academies promote science only through advice, evaluation and promotional activities, while others run their own - occasionally quite large - research institutes. The latter was particularly common in Central and Eastern Europe where the best research was long done within academy institutes; in fact, in many East European countries that is still the case. Nevertheless, it may be more interesting to see what all these academies have in common than to focus on the many differences between them.
Whatever their structure and tradition, academies in Europe have three common objectives. First, furthering critical scientific thinking in society. Second, advancing top-level scientific and scholarly research. Third, promoting the independence and freedom of science. Autonomy is an essential precondition shared by all academies. Indeed, full independence is a precondition for being truly useful as an advisor. The emperor Justinian cut off a vital source of political life when he closed Plato's Academy a millennium after its founding because its views were not in line with his own. In the same vein, governments do not realize how much they wrong themselves by packing advisory committees with scientists who share the administration's political outlook and become comparatively useless "yes men." *Nature* (30 January 2003) expressed its concern that "the current U.S. administration has so politicised the provision of scientific advice that it could permanently undermine public trust." Conversely, we should be proud to serve on bodies that consider independence a primary criterion for operation. Without this independence and freedom, science will sooner or later become stagnant, irrelevant and useless.

In creating ALLEA in Europe we have gone beyond the level of individual national academies. ALLEA was founded in the beginning of the nineties as an umbrella organization for all the national academies of Europe. This was a logical consequence of the ever-growing internationalisation of research and scientific collaboration, and of an increasing tendency to lift discussions and decision-making about science and science policy from the national to the transnational (e.g., European Union) level. One level will not replace the other - there is a good case for subsidiarity and the preservation of separate national traditions and identities - but in European policy making there has been a noticeable shift in balance towards the supranational level.

**Scientific collaboration**

Scientific collaboration in Europe is increasing sharply, not only because of the European Framework Programme funding for cooperative projects - although that is a strong incentive - but also because science itself has developed into a truly collaborative and international activity. One can no longer readily do good scientific work in a remote place without regular contact with colleagues. New communication technologies have made international cooperation much easier, resulting in research proposals and activities becoming increasingly international in nature.
There are several reasons why we should collaborate more than before. First, many of our highest priority subjects are themselves international in character. One cannot study environment, infectious diseases, transportation, trade, migration or economic recession from a purely national perspective. We have to collaborate to get a full picture. Second, for many of the mega-programmes national funding alone falls short of what is needed and only combined efforts can provide the necessary infrastructure and means. Third, Europe needs to strengthen its competitive position relative to the United States and Japan. A few years ago a 'green book' was published that gave Europe high marks for the quality of its education and research, which can indeed compete with the United States. However, Europe falls really short if one looks at how effectively all that knowledge and insight are translated into industrial applications, patents and other forms of technological utilization when compared with the United States and Japan. That crucial translation is truly lacking in Europe.

There are many reasons for this disparity. Patent laws are different in different European countries, venture capital is difficult to raise in Europe, and Europe is more risk-shy than the United States and Japan. Still, the difference in output in terms of industrial development is uncomfortably large and still growing; and increased cooperation and harmonization are needed. And last but not least, there is a moral obligation for Western, economically more advanced countries to strengthen the R&D capabilities of economically less-developed countries, including a number of (central and eastern) European countries. Sometimes it is primarily assistance and not so much collaboration that is required, which, however, could eventually lead to collaboration for mutual benefit. In the long run, such collaboration is the best precondition for peaceful coexistence and economic balance in the world as a whole, and thus beneficial for all. The message is clear: national academies in Europe must cooperate.

Let me elaborate a bit further on this supposed harmonizing and peace-making function of science. It can be argued that the universality of natural science laws is the fundamental advantage of science and the driving force behind its development. The laws of physics and chemistry or life sciences - often expressed as mathematical formulas that form the true scientific lingua franca - are applicable everywhere, and scientists from all over the world can participate in the scientific discourse. In fact, it is considered foolish for scientists not to take part in such discussions, since this is the only way for science to progress and for individual scientists to develop. In line with what has been said above, I would submit that such collaboration almost always
creates a better understanding of common goals. Where there are differences in approach or methods, collaboration will lead to a greater sensitivity to and, often, a greater appreciation of such differences in approach.

It can even contribute to the mitigation and prevention of conflicts between nations, notably in two ways. In the first place by the persuasive power of scientists' belief in rationality and rational solutions as well as by their tradition of coping with conflicts by agreeing on the rules of rational decision making. These include a proper definition of the question, agreement on the methods to be used, a logical analysis of the arguments, the evaluation of the adequacy and sufficiency of the data supporting these arguments, the resolve to collect additional information, if necessary, and, then, to postpone definitive conclusions until further evidence has been acquired.

A second factor that contributes to conflict resolution or prevention is the required attitude of openness and collaboration and a need to communicate in the search for the truth. Collaboration in research presupposes the exchange of knowledge, expertise and results and requires a genuine attempt to understand and criticise others' work. Even during the darkest moments of the Cold War there was still scientific contact between the scientists of the Soviet block and those of the Western world. I am convinced that active dialogues between scientists of countries in conflict help to build bridges of trust.

Let me repeat the remarks in my Presidential address at ALLEA's General Assembly in Brussels in respect of the recent terrorist attack in Madrid: All indications point to fanatic and fundamentalist Islamic cells being responsible. But the creation of a mistrustful atmosphere vis-à-vis scientists from Islamic countries, or the exclusion of certain Islamic countries from the scientific discourse, is not only ineffective but also unacceptable as stated, for example, in the ICSU's doctrine on the universality of science. On the contrary, more contacts and more intensive collaboration with scientists from Islamic countries could help to further insights into possible philosophical and cultural differences, and could contribute to a better understanding and trust. Science and scholarship are the vehicles par excellence for building bridges between cultures.
European collaboration and the Framework Programmes

Much of the European research collaboration has taken place within the Framework Programmes. Collaboration, especially in the context of the last two FPs, has not been restricted to EU countries. Under certain conditions openings have been made and used for the inclusion of the countries that have recently gained EU access, and even of the pre-accession countries. Added European value was conceived as the collaboration of research groups from three or more countries in Europe, which meant some improvement indeed on the previous fragmented and often duplicating activities.

In a recent communication the European Commission expounded its future policy to support research in Europe (Science and technology, the key to Europe's future, Brussels, 2004), which again includes a number of rather fundamental changes. The communication starts by justifying the requested doubling of the EU research budget by pointing out, among others, that scientific research, technological development and innovation are at the heart of the competitive knowledge-based economy that Europe has set as its aim. It refers to an integration of research efforts' importance for a furthering of the European industrial policy, to the European added value by establishing a critical mass of resources, and to the need to strengthen excellence through European competition. It further points to the strongly increased expenditure needed for research due to its increasing complexity and scale. The budget increase will have a catalytic effect on the national initiatives that will be coordinated in certain countries' areas of interest, or in those areas of interest to all. It will, as is expected, also have a leverage effect on (badly needed) private investment in research in Europe, which at present is often done outside Europe.

In terms of response the 6th FP was a great success. Some 28,000 research proposals involving 50 different countries have been submitted. Furthermore, some 200 major networks and 55 programme network actions have been launched involving highly advanced subjects, among others in the (bio)medical and nanotechnological domain. But, as the Commission observes, the FP has been the victim of its own success. Given the restricted budget only 1 out of 5 proposals could be supported; furthermore, only half of the proposals found to be of a very high standard could be financed. This cannot continue. With such a low success rate researchers will lose their motivation and withdraw from the programme. In addition to an increase in the budget, a number of further proposals are made for the next period (the 7th programme), including:
a. Creating European centres of excellence through collaboration between laboratories and institutes as a follow-up of the earlier initiatives such as the 'networks of excellence' and 'integrated projects'.
b. Launching European technological initiatives, a continuation of the technology platforms that have recently been set up and in which academia and industry are expected to join forces.
c. Supporting basic, science-driven research through competition between teams and individual researchers with peer-reviewed scientific quality as the sole criterion, along the lines of the proposed European Research Council.
d. Improving the attractiveness of European science for researchers, aiming at the initial research training, as well as attracting more women and more foreign researchers. In line with the Marie Curie programme this will be realised inter alia through scholarships, life long career development and improved intra-European as well as international mobility of students and young researchers.
e. Improving the (access to) European research infrastructure by supporting the construction and operation of new infrastructure (equipment, archiving systems, and databases) as well as transnational access to this and existing facilities.
f. Coordinating national research programmes; further support will be given to national research councils' joint programmes and activities; resources for ERA-NET activities will be increased (in ERA-NET+ the Commission will not only pay the costs of coordination, as was the case in ERA-NET, but will also pay 10 to 15% of the actual invested budgets). In addition, some of the activities of the European intergovernmental research organizations, such as CERN, EMBO, EMBL, ESO, will be directly supported, particularly those activities from which Europe would benefit by their being conducted at European Union level.

Except for those activities in c above (ERC), the choice of all Framework-supported activities will be based on the prioritization of subjects for which support at the European level is most needed. In other words, except for those subjects in c above, the research will be strategic or applied / technological in nature. The topics that have been identified (by a study of the Joint Research Centre (JRC)) as relating to the European Union's policies and which will receive particular attention are: health, consumer protection, energy, the environment, development aid, agriculture and fisheries, biotechnology, information and communication technologies, transport, education and training, employment, social affairs and economic cohesion, justice and home affairs. Two new areas have been added: space (in
collaboration with the European Space Agency, ESA), and security, including direct research into organised crime and international terrorism, as well as the conditions for international security, such as preserving peace and preventing conflicts, in keeping with the principles of the United Nations Charter.

There was a good deal of complaint about the lengthy and bureaucratic procedures and paperwork involved in the FP programmes. The Commission intends to improve the FP operations, to simplify the financial rules, and to make the evaluation procedures more transparent. Much of the support will be given in the form of grants, which require much less control than co-financing contracts. We expect research proposals for the European Union's 7th research FP at the beginning of 2005.

At present there is some consensus among academia and politics' representatives that in order to make Europe a respected competitive player in world economics again, a substantial increase in R&D investments will be needed. Europe has set an expenditure of 3% of GDP as its target for spending on R&D by 2010, two thirds of which should be provided by private investments (the so called Lisbon objectives). A recent report by the Confederation of Swedish Enterprises (http://sn.svensknaringsliv.se) indicates that, while progress in some areas has been made, the EU as a whole is still a long way from this target. The European Academies Science Advisory Panel (EASAC) has devoted a conference to this pressing problem, presenting Sweden and Finland as successful prototypes (EASAC, 2004). Moreover, the Confederation Report shows that with respect to many indicators the 'acceding countries' are in an even more difficult position. However, the report is not too pessimistic about these countries, citing the relatively high educational level in most of these countries as a positive factor. That is an important message, also for SEE countries where this may apply as well. Since the Ministerial Conference in Berlin in September 2003 all SEE countries now participate in the Bologna process that aims at a standardised accredited Bachelor/Master programme in higher education. Given the strong interest in higher education, particularly in science and technology, in many of the SEE countries and - quite importantly - relatively more among women than in Western countries, these countries should capitalise on this important potential contribution to the human resources needed for the developments of science in Europe as a whole. An expert group, chaired by the former Portuguese Science and Technology Minister Jose Gago, has pointed out the (future) lack of well trained scientists as one of Europe's crucial vulnerabilities on its way to the Lisbon target. It is here
where countries with less financial resources but with a high potential in human resources can really contribute.

Regional collaboration in SE-Europe

Let us now consider what these general considerations and the guidelines for future European Union research policy, discussed above, mean for the regional collaboration in the South Eastern region of Europe. In the following we will list a number of consequences and considerations, although this may not be exhaustive.

(1) Given the history of conflicts and struggles in the SEE region, and in view of its peace-making and bridge-building potential, collaborative research in this region could certainly be beneficial for a more peaceful and less conflictual climate in this part of Europe.

(2) Many problems that need to be researched transcend the limits of one nation in this region and have an international character. They cannot be adequately studied from a single national perspective. One may think of geological and climatological studies, migration and minorities, the historical, linguistic and cultural roots of ethnic groups, industrialization and environmental effects, agriculture and food, biomedical and health studies, and many others. Collaboration between countries is the appropriate way.

(3) The infrastructural costs of high-level research in many scientific fields have increased exponentially over the last few decades. Often single nations, certainly in the SEE region, lack the necessary financial resources for such advanced facilities. Moreover, *Nature* (vol. 428, 1 April 2004) revealed that due to market conditions scientists from central and eastern European countries have to pay up to 70% more than their wealthier colleagues from the West for identical supplies! Still, it is important to have such advanced apparatus and facilities at one's disposal -- not only to keep up with the rest of Europe, but also to counteract the brain drain. We know that bright young researchers primarily leave because of an uninspiring research environment and an inadequate research infrastructure. Regional collaboration can nullify the problem of lack of finances. A suggestion could be to ask an expert group representing different interested countries to recommend two or three large research facilities (for nano, radiation and laser research, biomedical research, large scale computing and networking facilities, or whatever deserves priority) on the basis of a thorough analysis of the region's needs and opportunities. These countries should then combine their (public as well
as private) resources to realise these plans. Moreover, since it is assumed that we deal with 'open access' to these facilities, additional European financial support can be acquired as is indicated in the Commission's Communication. It is certainly advisable to align the plan with the strategic choices of the 'European Strategy Forum on Research Infrastructures (ESFRI)', the body set up by the EU member states in 2002 with which to consult one another on matters related to infrastructures that are significant to Europe.

(4) SEE countries should also bundle their educational and training facilities more than before. Smaller countries cannot excel in every field of science and scholarship, but jointly they can, of course, offer more opportunities. Cross-national programmes and easier access to one another's educational and research institutes would provide a better opportunity for students and young scientists to broaden their knowledge and experience, and, again, make it more attractive to remain in or return to their native country. This is, therefore, a plea for higher regional cross-national mobility. It is clear that this is not only in the hands of scientists and educators: legal provisions restricting free study and work and visa regulations have to be adapted as well, but pressure from universities and academies will help. EU funding, more generous that to date it is hoped, will also be available to improve mobility. It is important to also streamline the various educational systems. Full participation and reform with respect to the Barcelona process has to be ensured. It is fortunate that a series of university evaluations has taken and will take place in the SEE region under the auspices of the European University Association (EUA) (Annual Report EUA, 2003). Since 2002 an 'Education Reform Initiative of South Eastern Europe' has taken over the SEE Stability Pact's Higher Education working group's responsibilities, and has formed various regional networks to address the harmonization process. Let us hope that they will remain active and successful.

(5) Countries in the SEE region's collaborating consortia would also be stronger partners in exchanges and collaborations with more established EU member states with an often stronger scientific tradition and support. At present the SEE countries have quite a few exchange and collaboration agreements with Western European countries, but their lack of size and modest facilities generally put them at a disadvantage. Stronger regional collaboration in research and education will increase their critical mass, broaden their scope and present them more readily as fully-fledged partners. A country in the SEE region may eventually become a place for foreign researchers to go and spend some research time. Ideally, mobility will become reciprocal and the brain drain will be compensated by a brain gain.
The SEE region countries have a number of serious problems in common: stagnating economic growth, unemployment, little technological innovation due to limited financial and human resources, and fragmentation of the efforts to meet these problems. In fact, many of these problems occur in the wider Europe as well. It has been acknowledged that world-class scientific research and development are essential for Europe's future prosperity, but there is also agreement that the successful integration of such R&D into the fabric of European society (homes, supermarkets, industry, transport, health systems etc.) is a sine qua non for delivering benefits. The sector-by-sector-based European technology platforms, as proposed by the European Commission, assemble all relevant stakeholders (academic, governmental, political, business and banks) in this process in order to remove the obstacles and barriers to large scale innovation. The idea of such technological platforms is not new. They already exist in many European countries at a national level. In fact, the objectives and practices of EUREKA resemble this proposal. There may be some merit in EURAB arguments (EURAB 04.010) to rather speak of 'Innovation Initiatives' than of the somewhat restricted 'Technology Platforms', but such a concerted effort to develop a vision and a strategy to increase R&D, and to coordinate concrete actions and implementations could certainly be instrumental in effecting the necessary change. There is no reason why this idea of an Innovative Initiative for the whole of Europe could not be successfully applied with respect to a region within Europe as well. It could then aim at the more specific regional opportunities and obstacles and could be of optimal benefit for that particular part of Europe.

One should not forget the traditional funding available for cooperation such as that provided within the EUREKA and, especially, the COST programme. The latter is, as the acronym implies, explicitly meant to fund cooperation in science and technology. COST has existed since 1971 and is still quite viable with some 200 actions supported each year. Since also non-EU countries have equal access to the programme, it also builds bridges to emerging countries. The prerequisite that at least 5 countries should be involved is easy to comply with within the SEE region.

ALLEA has taken a sympathetic position with respect to proposals regarding the new European Research Council (ERC). Within this envisaged scheme scientific quality will for the first time be the sole criterion for EU research grants. European added value will no longer be defined in terms of cooperation between two or more member countries, but as excellence emerging from true European competition. This is an important amelioration.
Conversely, attempts to achieve a representative and honest distribution of grants across countries will not create excellence and will mean sub-optimal usage of available funding. There is one important implication, however. Promoting only top quality could keep a great many struggling research groups from economically less privileged countries locked into an unfortunate position, and could mean that a great many parts of Europe will be deprived of European financial support for research for some time, creating a 'science divide' between the haves and have-nots. A recent ALLEA position paper (ALLEA, 2004) suggested that excellence should be maintained as the sole criterion for ERC grants, but simultaneously other European funds - Structural Funds and Cohesion Fund - should be used to support infrastructure and to retain bright young students and scientists in European countries with a less developed status. Incentives for the latter could include travel grants, stipends, interim salaries for young researchers returning to their country, grants for computer or experimental equipment etc.

(9) This brings us to our final point: the use of structural funds. The European Commission has addressed the role of the regions in the overall ERA building process (COM 549, 2001, final), stating that Regions should emerge as dynamic players in developing and structuring the European Research Area. According to the Commission, geographical proximity remains one of the most powerful factors stimulating intellectual and commercial exchanges and, consequently, the innovation process. The so-called solidarity instruments, the Structural Funds (European Regional Development Fund (ERDF, 1975), European Social Fund (ESF, 1958), European Agricultural Guidance and Guarantee Fund (EAGGF, 1958), Financial Instrument for Fisheries Guidance (FIFG, 1993)) and the Cohesion Fund (environment and transport, 1993) are intended to narrow the development gap among the regions and Member States of the EU. Some €36 billion (about one third of the EU budget) was spent through these funds in 2004. The use of structural funds for R&D development would be in line with the Committee of the Regions' point of view that welcomed the Commission's proposals that RTD should become one of the most important priorities for the New Structural Funds 2007-2013, but stressed the need to support basic research on the one hand and to reach a fair balance in R&D opportunities between European regions on the other; in other words, to differentiate between FP research funding and Structural Funding. The former 'must promote research' and the latter should be used 'to remove the regional imbalances in research, innovation, training facilities and
infrastructure'. In a recent advice, EURAB has proposed a number of useful and supporting options focusing on the future role of these Structural Funds with regard to the given objectives (EURAB 04.037). There is one aspect that may require further concerted action by academies, universities and research institutes in the region. We know that Member States have the last word in terms of priority setting with respect to the spending of the Structural Funds despite the fact that the Commission can make strong recommendations on the appropriateness of these choices. It is crucial to convince the recipient states of the importance of investing in R&D, and to reserve a significant part of their revenue for this purpose. Governments need to be convinced of the absolute importance of investing in this area, which is not easy since the returns on investment are rather long term and not immediately visible. If the regional academies and universities join forces and set out together to convince their governments of this high priority, they may be more successful than if they work individually.

Conclusion

In this paper we have tried to show that there are many opportunities for and beneficial effects of more intensive regional scientific collaboration. The saying 'united we stand, divided we fall' is definitely applicable here. Moreover, we have to consider this regional collaboration in a wider perspective as well: there is no doubt that better cooperating regions in Europe will work out favourably for Europe as a whole.

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Recent Developments in European Science Policy: ALLEA's Point of View

Kiev, 2003*

Introduction

The subject of the international IAAS-symposium 'Basic research in the modern innovation process' is both propitious and timely. In many research organizations and governmental agencies that are dealing with science and research policy in Europe, not only at the national but also at the European level, the desired balance between basic and applied research, the relevance of fundamental science and its contribution to technological and economic developments is under discussion. In this paper we will touch upon a few of these discussions and elaborate each time on the position and contribution of ALLEA in this debate.

For information to those who might not be fully acquainted with ALLEA as organization the following: All European Academies is the European network of National Academies of Sciences and Humanities. It was created when new opportunities for cooperation arose in the 90s as a result of the end of the cold war, and in the context of the increasing significance of supranational organizations and institutions in the area of science and higher education. At present it has 48 members (i.e. national academies) from virtually all European countries from the Atlantic to the Urals.

European Research Area

In January 2000 the European Commissioner for Research, Philippe Busquin, launched an in the meantime well known and widely discussed grand idea: the European Research Area (ERA), a truly European vision on the promotion and furthering of research in Europe. ERA aims to develop a European-wide research policy of both national and European objectives and priorities. Major changes are introduced by ERA as far as research management and funding are concerned. ERA was and is an ambitious plan that aspires to result in better coordination between the Commission and Member

* Presentation at the conference 'Basic research in the modern innovation process', Kiev, Ukraine, 22-25 December 2003
The launching of the ERA-idea has initiated a lively debate in which a multitude of science policy makers and scientists participated. Countless reactions, comments, articles and critics have appeared in the press and the debate is still at full blast. Also the Commissioner has cast further light on his ideas in numerous talks, interviews and publications. One of these Communications, which is particularly relevant to the theme of the present conference, is 'More Research for Europe; towards 3% of GDP', published 11-09-'02. In this communication Busquin referred to the so called Lisbon declaration of the European Council (March 2000) in which the Heads of State set the objective "to become the most competitive and dynamic knowledge-based economy of the world, capable of sustainable economic growth with more and better jobs and greater social cohesion by 2010", and to the subsequent Barcelona European Council agreement in 2002 stating that "research and technological development investment in the EU must be increased with the aim of approaching 3% of GDP by 2010, up from 1.9% in 2000." More attractive framework conditions are essential for Europe if it is to achieve this investment objectives, the Communication continues. Among the most important suggestions are: a sufficient supply of highly qualified human resources, a strong public research base, a dynamic entrepreneurship culture, adequate systems of property rights, innovation friendly regulations, supportive financial markets, macro-economic stability and favourable fiscal conditions. It is further stated that actions should be launched at the European level, but also that more needs to be done to ensure that it is delivering results at national and local levels. At the same time - and this is an important addition by the Commissioner - it is recognised that the diversity of situations in Member States and Candidate Countries must allow for a 'differentiated policy response'.

ALLEA has responded to this Communication with a letter, asserting the following points:
(1) ALLEA agrees with the view that the creation of a European Area of Research and Innovation is a key condition for the European Union to become a leading knowledge based economy in the world, and that the objective to raise the percentage of European GDP to be spent on R&D from the present 1.9% to 3% by the year 2010 is both ambitious and laudable.

(2) ALLEA is in agreement with the Commissioner when he suggests to allow for the rather large diversity that exists in the national and regional conditions both in terms of overall level of R&D investments and the balance government-business funding, and to plea for differentiated policies towards the 3% objective. It is in particular the candidate countries in which the share of the business funding remains very low. ALLEA would have appreciated a somewhat more specific elaboration of this differentiated policy, and the specific support which the Commission has in mind. In this connection reference is made to a recent report of a ALLEA-working group under the chairmanship of Prof. Jüri Engelbrecht, President of the Estonian Academy of Sciences (National Strategies of Research in Smaller European Countries, Amsterdam, ALLEA Report Series, no. 1), in which a number of recommendations and steps to be taken by policy-makers are suggested, in order to develop a strategy of research in smaller European countries. The recommendations include ensuring the quality of research, capitalising on the existing strengths, achieving an optimal balance between science-driven research and meeting society's needs, stimulation of networking, mobility and (small scale) cooperation, strengthening the administration and improving the research infrastructures.

(3) ALLEA shares the Commissioner's grave concern about the declining attractiveness of natural sciences and engineering among students and young researchers in many European nations, a tendency which is even aggravated by a growing net outflow of S&T human resources from Europe to the US. Great pains should be taken to stem this unfortunate development. According to ALLEA a variety of measures and strategies could be considered, including:
- The encouragement to develop and to implement programmes for raising interest in sciences at an earlier stage of development of the youngsters (such as for instance the French programme "la main à la pate");
- The stimulation of more women to pursue a scientific career in science, also by creating favourable conditions, including part time work, temporary employment, opportunity for home working, provisions for children, etc. As was rightly observed by the Commissioner there is a large potential of so far sub-optimally utilised female scientific research capacity in Europe.
- The stimulation of networks of excellence, but in a somewhat more flexible way than is envisaged in the 'new instruments' in FP6. Networks could be also smaller in scale, less stable, more temporary and more on an ad hoc basis. The idea is that scientists in Europe should enjoy being able to capitalise on all the available top-expertise which might be spread throughout the continent. Such an increased flexibility and mobility should contribute to making Europe an attractive region to work in research.

- The stimulation of flexible retirement in order to stop the outflow of experienced scientists and the loss of human capital via early and mandatory retirement programs. It is widely known that a considerable percentage (est. 25%) of senior scientists would prefer to continue their career if they would not be kept from doing so because of legal reasons (mandatory retirement) and/or working conditions (full time vs. part time, executive and/or supervising responsibilities vs. consultant and/or coaching tasks with respect to junior scientists). It would be worthwhile to pursue this venue to prevent or at least to relieve the pains of what the Germans would call the Nachwuchs problem, caused by the massive retirement of the baby boom generation of scientists in the coming decade.

- An increased mobility from outside Europe, by removing many formal, legal and informal obstacles that frustrate an optimal inflow of non-European scientists at present. Many such suggestions were brought to the fore at a recent Estonian Ministry of Education conference (September 19-20, 2002) on the theme: 'Flexible Europe: mobility as a tool for enhancing research capacity.'

- Investment in research infrastructure, equipment, computer facilities and travel funds for scientists. Generally, it is more the conditions and facilities for research than salaries or honoraria that attract scientists.

- The creation of sufficient room for free, science driven, basic research. Many young scientists are attracted to a research climate where scientific creativity is treasured, and pure scientific motives and criteria are predominant in the evaluation of projects and competition between scientists. It is clear that this type of climate is to be found primarily in university or research institute settings, supported by public funding. This is another argument for further stimulating governmental R&D funding in Europe.

- Paying more attention than in the past 'ivory tower' period to questions of public and social responsibility of scientists. Part of the present public reservation or even negativism with respect to (products or putative effects of) science and technology (modified food, genetic engineering, cloning of animals or even human beings, environmental degradation, nuclear energy)
find their ground in a wrong presupposition that the essential condition of freedom and autonomy of science would exclude social and moral responsibility for its products and consequences. Contemplative and serious attention of scientists to these societal and ethical questions, and proper communication with the general public could mitigate some of the existing negative attitudes towards natural sciences.

(4) ALLEA fully endorses the plea for improving the EU intellectual property right legal framework, the international harmonisation and enforcement of IPR systems, and the promotion of the use of good practices in publicly funded research. The delay of an adoption of measures to establish a unified IPR system in Europe is detrimental to optimal investment in R&D. At the same time ALLEA is concerned about a number of worrisome aspects that have been brought into the fore by the ALLEA standing committee on intellectual property rights, under the chairmanship of Prof. Roger Elliott. These aspects include the unfortunate tendency to tighten the rules for copying materials for own study, teaching and research, the tendency to inhibit the scientific re-use of data from (overprotected) databases, the increasing pressure of researcher's employers (university, institute, funding organization) to retain potentially profitable inventions against their wish their research results to be widely available for debate and retesting, the pressure on scientists to carry out the type of research that may result in patents, the passing of 'discoveries' for 'inventions' (which leads to deplorable initiatives to patent DNA-sequences). We have to guard against creating intellectual property rights in knowledge that may be to the detriment of the academic freedom of exchange and access.

(5) Although the primary affinity of ALLEA (and its member Academies) lies at the 'science' pole of the 'science - applied science - development – implementation' chain, it can declare its adhesion to the various proposals on research- and innovation-friendly regulations, on the improvement of interactions between academia and industry, and on the amelioration of macro-economic, financial and fiscal conditions, in order to stimulate the research capacity in the private sector and the effective use of public financing for business R&D. ALLEA takes, however, the liberty to express one concern with respect to all these ideas and proposals, and that is the question whether the cutting-edge, curiosity-driven, fundamental research, which remains a prerequisite for true science development and innovation, will be sufficiently safeguarded, if industry and the private sector in general are determining too much the research agenda. It should be acknowledged that the optimal balance between science and technological application may
vary over European countries, depending on the level of economic development and growth, but at the same time it can be defended that a forced and excessive inclination to steer scientific research towards application and technological development is detrimental not only for science development itself, but in the long run also for the development of technological applications. New technologies require new knowledge, and that is generated by science-driven research.

**European Convention**

Under the chairmanship of Giscard d'Estaing a committee of representatives of the different EU-Member States (European Convention) has worked over the past year to draft a Treaty establishing a Constitution for Europe, in which the rules and regulations for future Europe are proposed. Already in November 2002 the European Research Advisory Board (EURAB) stipulated that research (basic research, applied research and technological development) plays a crucial role in the knowledge society and should be adequately defined and be acknowledged explicitly in the Treaty. Various other European research organizations have joined EURAB and have made similar suggestions.

ALLEA has also taken the liberty to address the European Convention on the issue of the importance of scientific and scholarly research, and its indispensability for both the intellectual and cultural development, and societal and economic welfare. In a letter to the Convention it has taken the following position and made the following suggestions:

A more defined and acknowledged space should be devoted to scientific and scholarly research (both fundamental science-driven research and applied research that tries to meet the needs of society) in the Constitutional Treaty.

The national academies of sciences and humanities in Europe are convinced that 'science matters'. Not only do they believe in the intrinsic value of scientific knowledge in a civilized society, they are also confident that proper scientific research is indispensable for the desired development of societies and the well-being of mankind. And this desired development includes economic development. Experts agree that the stimulation of research and development is a crucial part of the solution of Europe's declining competitiveness and, its consequence, the rising levels of unemployment.

A 'green paper', published by the European Commission some time ago, spoke about the 'European paradox', suggesting that in comparison with its
principal competitors in the world the production of high level knowledge of
the EU states was still first-rate, but that Europe seemed insufficiently able to
transform this knowledge into useful technological applications. This would
be a strong argument for an increased effort in the area of applied research
and technological development.

But there is more at the present moment. If one notices the relatively large
number of American (based) Nobel prizes, the much higher investment of
European companies in the USA than vice versa, the large number of high
level European scientists who are attracted (and hired) by top American
universities and the distressingly limited brain drain from the USA to
Europe, and the fact that the EU engages substantially fewer researchers than
the US and Japan (as was brought to light by the Third European Report on
Science and Technology Indicators, 2003), there is ground for concern:
European science seems on the wane. This concern is further intensified by
the stagnation of R&D expenditure in Europe over the last five years,
whereas it has been significantly growing both in the US and Japan. If
Europe wants to (re)gain a prominent position in innovative industrial and
technological developments it has to take the promotion of science and
science education more seriously.

And for Europe there are attractive challenges in this respect. The
international nature of science and scholarship has always been apparent, but
it has become particularly conspicuous in present times through the
widespread use of fast and powerful means of communication. And the
opportunities for European science and scholarship are great, in particular if
the European countries are able and willing to unite their efforts, and if they
allow Europe to capitalize its rich expertise and knowledge. Some of these
ideas were already specified in the proposals of the European Commissioner
Busquin articulated in the European Research Area, and in the preliminary
thoughts expressed by the European scientific community on a projected
European Research Council. ALLEA has taken cognisance of a letter from
the European Research Advisory Board (EURAB) on this issue and endorses
wholeheartedly the thrust of this letter.

ALLEA concluded by saying that it would like to see in the Treaty a
stronger promotion of the view that economic prosperity as well as the
furthering of welfare, well-being, justice, and other societal values in the 21st
century can only be achieved in the context of the development of a
knowledge-based society, and therefore requires an appropriate acknowledg-
ment and considerable support of scientific and scholarly research and
education.
In the meantime the draft Treaty has become available, and in the formulation of the articles concerned the restriction of the definition of 'research' to short term, targeted research and the confinement of its expected value to economic utility and the contribution to technological development is far from illusory. ALLEA has, therefore, decided to make an additional plea, this time more specific in support of fundamental, science driven research in the following terms:

"In line with its earlier letter to the European Convention (dd. 7 May 2003) ALLEA, the European Federation of National Academies of Sciences and Humanities, would take the liberty of pleading again for a more acknowledged place for fundamental, investigator driven scientific and scholarly research.

In Section 9 (article III-146) of the draft Treaty that has been submitted to the Presidency of the European Council the Convention's viewpoint was phrased as follows: "The Union shall aim to strengthen the scientific and technological bases of Union industry and encourage it to become more competitive at international level, while promoting all the research activities deemed necessary by virtue of other chapters of the Constitution". It is ALLEA's opinion that in this statement too little room is left for fundamental or strategic research and knowledge, and for maintaining and strengthening the great European intellectual and cultural tradition. Not only does it insufficiently acknowledge both the intrinsic value of scientific knowledge in a civilized society, and the need for basic research and knowledge for the furthering of a harmonious cultural, social and democratic development of a society, it also too little recognizes that basic science-driven research is a sine qua non for really innovative technological and economic developments. If the ambitious and laudable objectives of the strategy adopted by the Councils of Lisbon and Barcelona are to be realized, and if the European Union is to develop into one of the most competitive knowledge-based economies of the world, more importance should be attached to the social, cultural and economic significance of basic scientific knowledge and scholarship.

ALLEA would make so bold as to urge the European Council to accept an additional phrase in Art.III-146, section 1, on the promotion of scientific knowledge and to express its support for fundamental scientific and scholarly research without immediate reference to (short term) economic utility or technological application....".

Other European science organizations have taken more or less similar positions, and in order to enforce the possible impact a concerted action was
undertaken at the recent World Science Forum in Budapest (8-10 November, 2003), by emitting an open letter to the Research Ministers in the EU Member states and countries that will join the EU on 1 May 2004, signed by the Presidents of All European Academies, the European Science Foundation, the European Academy of Sciences and Arts, Academia Europaea and EuroScience. The open letter is phrased as follows:
- The European scientific community recognises the significance of the Constitution for Europe in shaping the future development of the Union. Impact of science and scholarship is a crucial tool that will underpin many aspects of this development.
- The draft Constitution for Europe is a considerable step towards the establishment of a solid legal basis for scientific co-operation in an enlarged Europe. But in its present formulation the draft Constitution for Europe is not ensuring optimal possibilities for scientific co-operation and progress in Europe.
- In Section 9, Article III-146, too little room is left for fundamental or strategic research and knowledge, and for maintaining and strengthening the great European intellectual and cultural traditions. The European scientific community urges the Research Ministers to intervene with the European Council to accept an additional phrase in Article III-146, point 1, on the promotion of scientific knowledge without immediate reference to (short term) economic utility or technological application. The Union's support for fundamental scientific and scholarly research and scholarship in our collective future development needs to be explicitly stated.
- Further, the European scientific community wishes to stress that the Constitution for Europe should alleviate the threat of creating a Europe of two (or more) speeds in the research area. The scientific communities of Periphery Countries and Regions must be well integrated into the European mainstream of research. Appropriate reference is necessary to be included in Article III-148.

**European Research Council**

An editorial comment in *Nature* (21 June, 2001) cautioned the ERA by saying that it is likely to remain a bloodless vision unless there is an independent, flexible and self-administered pan-European funding body which - unlike the ponderous Framework - can react quickly to unexpected scientific developments.
As an almost immediate compliance with this precondition the ideas on the creation of a European Research Council have gained momentum through the preparatory work of the European Research Council Expert Group (ERCEG), which was set up on the initiative of the Danish Minister of Science, Technology and Innovation during the Danish EU-Presidency. The ERCEG has made use of a variety of viewpoints, comments and reactions that have been evoked by the position paper on a possible ERC that the Danish Research Councils distributed as background paper for an invited conference on this subject in Copenhagen, October 2002. ALLEA has also submitted a viewpoint which was taken after ample consulting with all its Member Academies. The main elements in this viewpoint were the following:

Given the widening gap between Europe and its main global rivals in the field of science and technology and the decrease or stagnation of the research funding in many European countries a concentrated effort to develop a true and partly remodelled European research policy, including its funding, is necessary. For this 'European Research' we need more than the sum of the different national research programmes, the intergovernmental cooperation agreements (Eureka, Cost), the cooperative arrangements within some disciplines, such as AMICA (agriculture) and CERC3 (chemistry), or the "big science" institutes such as CERN, EMBO, ESA, ESO, as we have at present. ERA and FP6 are important steps forward, but remain Community instruments, for which consent of the partners is needed (art.166 Treaty of Amsterdam). In the context of the FP's it will be extremely difficult to transfer (some of the) national resources to the European level. Moreover, the requirement of fair participation and acceptance of countries in collaborative projects for formal (political?) reasons may be laudable and defendable given the need to build a balanced research workforce all over Europe, and to help and train the less advantaged participants, but does not always lead to top performance and excellence.

The linking of national programmes into a truly European research policy so far has proven very difficult to achieve. Policies and funding remain predominantly national. The principle of juste retour determines actions and attitudes.

ESF has made some significant steps forward, including EUROCORES (transnational cooperation between national research foundations; there is variable geometry, but each EUROCORE consists of at least four different participating European countries), Forward Look (as a solid basis for EUROCORES) and Research Networks. But so far it has not been possible
to create a truly European Research Fund with substantial autonomous policy making and independent review and funding procedures. Likewise, EUROHORCS has taken a good initiative (29-04-02) with its "European Young Investigator Awards", a funding scheme for selected young researchers (from anywhere in the world) to be supported for a stay of two to five years at a European institute or university. In all these initiatives, however, we are dealing with a very modest contribution. ALLEA, therefore, concludes that:
- Europe needs an integrated European science and research policy, that sees Europe as an entirety that is more than the mere sum of individual nations.
- Europe needs a European representation of the intermediate level of policy-and decision-making and funding of scientific research.
- The implicit goal of the ERA (the creation of a European research funding mechanism by pooling of EC funding and national resources) should be endorsed.
- Europe needs a new and generally accepted mechanism for the enhancement and promotion of quality research, for the funding of joint programmes and for coordination of existing programmes.
- For the realization of these goals a European Research Council seems to be an important and effective vehicle.

In addition, ALLEA formulated a number of conditions for such an ERC, the most important of which were that:
- The ERC should be run by highly esteemed scientists and should operate independent of national governments and the European government.
- Quality and the promotion of excellence should be the primary guidelines, to be judged by peer reviewing.
- Research programmes should include the training of (excellent) young researchers.
- The task and responsibilities of the ERC must not replace or compete with existing systems of coordination and financing of research in Europe. Therefore, coordination with existing European programmes (Framework programmes, Eureka and others) should be pursued.
- Financing should be provided by pooled contributions of EU funds (FP and other funds), National Research Organizations (National Research Councils or Academies), and private funds. Highness of respective contributions is subject for further debate, but some matching EC and national funding is desirable.
- As far as introduction and development are concerned one should think of a gradual evolution rather than an attempt to start with a full-fledged Council at short notice.
- With respect to the participation of the Central and Eastern European states (the non-(candidate) EU members) financial and other conditions have to be worked out, but a liberal and generous participation policy should be pursued. This not only for reasons of fairness and European solidarity, but also for reasons of salubrity and benefit for the European science: we need to mobilise all the scientific expertise available in the whole of Europe!

In an iterative process the ERCEG has made public various draft versions of its report, asking the various European science organizations to react on their proposals. The final report will be made available in December 2003.

On the basis of the latest draft versions of the ERCEG report it can be inferred that the ERCEG will propose to set up a European Research Fund for fundamental research, which must be managed at arm's length from the political system. It will further propose that the European Union sets up a European Research Council (ERC) as a major new European entity, with full autonomy in its operation and granting decisions. Since the ERC, according to the proposal, must be created by the European Union (and thus by the heads of state) it should be politically accountable to the EU, but it must operate as a scientifically autonomous body, based on the advice and guidance of the European research community. The main task of the ERC is to fund investigator-driven fundamental research of the highest quality in a strongly competitive mode, with applications evaluated by international peer review. The budget for the European Research Fund is to be received from the EU after approval from the European Parliament, most likely as a special line in the budget for the EU Framework Programme.

By the end of this year 2003 the European Commission will make public its (new) position with regard to basic research, and in spring next year it will publish a Communication on the European Research Council. Let us hope that the Commissioner will propose and find support for the promotion of a stronger European base for research and knowledge as well as sufficient room for basic, investigator driven research, in which an ERC, as foreseen by the ERCEG and as presently supported by most of the European stakeholders in the field of research and scholarship, will be granted a central role.
Let me start by expressing my appreciation for the Competitiveness Council's (and its present Chair's) efforts to keep the momentum in the preparation process of the European Research Council by organising this meeting on this significant subject. At the same time I express my gratitude for being invited to represent the scientists' and scholars' voice in this deliberation. Although in my function as President of ALLEA I primarily represent the Academies of Sciences and Humanities of Europe, after the past four years of active interactions and intensive discussions on the subject I dare to say that I am able to represent the general views on this topic within the European scientific community at large.

Scientists and scholars are not noted for their readiness to agree. So much the more striking is the heartfelt agreement of the European scientists and scholars on the value and the necessity of the promotion of frontier research at the European level, and of the creation of a European Research Council, an independent body run by scientists, intending to fund research projects of individual teams on the sole criterion of scientific excellence. Within the community of scientists and science organisations in Europe hardly a dissenting view can be discerned at present on the importance of the creation of a European science-driven research fund, and a science-controlled agency to manage this fund. The principle of allowing a researcher in any European state to compete with all others on the basis of excellence presents a new definition of European added value and is a significant improvement on the one used hitherto, which merely entailed the collaboration of research teams from different European countries. This view is officially endorsed by almost every European science organisation: the European Federation of national Academies of Sciences and Humanities (ALLEA), the European Science Foundation (ESF), the association of Heads of National Research Councils (EUROHORCs), the European Research Advisory Board (EURAB), the European Academies Science Advisory Council (EASAC), the European University Association (EUA), a great many European disciplinary societies, among others united in the Initiative for Science in Europe (ISE), and

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individual member organisations like Academia Europaea, EuroScience and others.

Science starts with curiosity, the wish to know the causes of and reasons for the observables and the desire to find scientific explanations for what has not yet been understood. In fundamental research these unanswered questions present themselves in experimentation, reflection and scientific discussions; they are science generated. In applied research these questions are offered by practical problems in industry, society or government. Theoretically and methodologically there is nothing wrong with applied research, but its origin as well as its goal is different, it is problem and solution oriented. I like to submit that science-driven research is essential, not only for the augmentation of academic knowledge, but also for the stimulation of economic growth and social welfare.

Let us elucidate in somewhat more detail on what grounds European scientists and science organisations have come to terms over the exigent need for an ERC. And let us do this by clearing a number of fallacies regarding frontier research in Europe, and the ERC as its promoting agency.

1. *The available knowledge in Europe is sufficient; we just need better translation into technological applications.*

The second part of this statement is true, as has been already pointed out in a warning green paper by the Commission in the 90's, but the first part is not. A variety of indicators, including the number of publications, the number of citations, the number of Nobel prizes and other prestigious awards, ranking of universities, net outflow of human resources in science and engineering, draw anything but a rosy picture on the state of affairs in science (and in particular in medical and life sciences) in Europe as compared to the USA and, in some respects even to some of the Asian countries. This is the more true if we consider the changes over the last decades.

2. *There is enough basic research in Europe; we just need more applied, targeted research.*

Although in recent discussions the distinction between basic and applied research becomes somewhat blurred, this statement derives from the misconception that fundamental, science driven research only serves the academic goal of augmentation of knowledge, and that it is not auxiliary, let alone pre-conditional for important technological and industrial innovations. Many examples can be given to prove the opposite: Maxwell's groundwork on the transmission of electronic waves resulting in Marconi's telegraph
some decades later, the rather fundamental mathematical Radon theory leading to the computer topography, the polymer chemistry in the 1920's laying the foundation for the later plastic industry, fundamental physiological research leading to innovative pharmaceutical remedies, the development of a device to exchange large files of data by a few physicists working at CERN sowing the seeds of the World Wide Web, which is mainly responsible for the enormous prosperity of the information and communication branch..... they all are cases in point. Let us not forget the warning of Laisant: "Si la science pouvait devenir exclusivement utilitaire, elle perdrait sa plus grande utilité". The knowledge base of Europe is its richest resource and Europe's economic and social future depends on the careful development and exploitation of this base. Innovation in a knowledge economy requires new knowledge, and new knowledge is especially generated by cutting edge, science driven research. Stimulation of the latter is an important means to become a winner in a world wide knowledge-based economy.

3. **Fundamental research should be sponsored by national funding; Europe should focus on targeted research.**

This is pretty much the present situation, and this has led to the fairly unfavourable position of many scientific disciplines in Europe. Of course, national funding should continue to support the fundamental research in the selected priority areas, and the complex pattern of funding of academic research in various European countries as well as the principle of subsidiarity should be recognised, but the added value of an additional European effort to boost cutting edge research is difficult to overestimate. It stimulates the integration of currently often fragmented research, it avoids unnecessary duplication, it creates sufficient critical mass (both in terms of infrastructure and human resources), it furthers mobility, improves European research capacity and attracts foreign students and researchers, and, above all, it brings central money to the most promising research teams in Europe, wherever they are located.

4. **Europe should concentrate on the natural and life sciences.**

It cannot be denied that many of the breakthroughs in science driven applications and technological innovations result from ingenious research in the natural and life sciences. But an exclusive focus on these disciplines ignores two things: Firstly, that many salient problems in today's Europe are complex in nature and require a multidisciplinary approach, with the inclusion of the social and behavioural sciences and humanities; think of the
interaction between informatics and cognitive science, agronomy and the socio-culture of farming, environment and sustainable consumption, health and risky behaviour, computer programmes and natural languages, nanotechnology and ethics, and many others. Secondly, that knowledge provided by social sciences and humanities as such is indispensable. In depth analysis of existing social conditions, intellectual histories and political systems, reflection on norms and values, the conspicuous role of religions, languages, musical and artistic patterns, landscapes and architecture in the shaping of Europe,...such knowledge has to be amassed through research, study and reflection, and needs to be available to avoid having to spend much money later to repair the damage inflicted upon society.

5. The Commission should fund and control the ERC
There is overall agreement among the European science organisations that central European funding of the ERC is needed, and the proposal within the 7th Framework Programme to reserve part of the funding for this purpose is greeted with great approval. However, there is also great consensus that, to ensure its acceptance, integrity and effectiveness the ERC needs to be modelled on the principles of self-governance, reflecting the established and well-proven model of the National Research Councils in many countries. Recently various European science organizations have expressed their concern about a possible different positioning of the Scientific Council. The ERC needs to operate as an independent body, and its governing Council of Scientists should not be an advisory body, but needs to be integral to the ERC in terms of policy setting, and decision making.

6. Public funding is enough, we need more private funding.
Again, the second part of the statement is correct. The first part, however, not, particularly if we regard the importance of science driven research as was done in the above. The ERC has to dispose of a budget that is commensurate with the socio-economic expectations; it should be of the order of the budget of the larger national research councils (i.e. between 1.5 and 2 B. € per annum). For comparison, the annual budgets in the USA of the National Science Foundation (5 B.$) and the National Institute of Health (28 B.$) indicate what it takes to make a continent-wide impact.
7. The ERC should have more responsibilities than just funding excellent research.

It is the strong opinion of the scientific community in Europe (including the representatives of the newly acceded countries) that the ERC's objective of furthering European top quality research should not be diluted by other, however laudable, goals, such as researcher mobility and the development of the scientifically weaker regions in Europe. With respect to the latter: Commissioner Potocnik's position that frontier research funds should not be used for solidarity purposes is generally endorsed. At the same time there is also agreement that specific measures should be taken (in particular the use of the solidarity instruments for RTD purposes) to ensure that these countries would be able to gain from Western European countries, and in due course draw level with the rest of Europe.

Mr. Chairman, these were some of the considerations of the science community in Europe with respect to the important subject under consideration. I hope they will make a positive contribution to your discussion. I also indulge myself with the hope that it holds for at least a number of you that I did preach the gospel for the already converted.
Investing in Knowledge in Europe:
Taking up the FP7-Gauntlet

London, 2005

Relevance of European research

Knowledge is Europe's richest resource, and concerted efforts to further develop this resource, as is proposed in the 7th Framework Programme, will be an important inducement to Europe's further cultural and economic growth. Much of the funding for the development and exploitation of this resource will continue to be found locally - and we trust that this national funding will continue, even if the European research budget is increased.

There is, however, a need to coordinate and develop Europe-wide competences if this knowledge base is to achieve its full potential. Academies of Sciences and Humanities have always had a particular responsibility for and expertise in the augmentation of knowledge, the promotion of scientific and scholarly research as well as the education and training of researchers. Consequently, ALLEA, the European federation of national Academies of Sciences and Humanities, has followed the development of the recent framework proposals with great interest. We believe that these propositions are a major step forward in the programme's catalytic role and strongly support the proposal to double EU research funding and extend the nature of the programme. ALLEA is pleased to note that both the European Parliament (Research Europe, 3 February 05) and the majority of European citizens (i.e. all the European Union states, the candidate countries Bulgaria, Romania, Croatia and Turkey, as well as the EFTA countries Iceland, Norway and Switzerland) support this increased EU research budget. As recently measured by means of the Eurobarometer (2005), 71% of all citizens agree that collaborative research at the EU-level is becoming increasingly important, and 64% feel that our economy can only become more competitive by developing and applying the most advanced technologies.

ALLEA particularly welcomes the proposed support for fundamental, investigator-driven research in all scientific, scholarly and technological domains, including social sciences and the humanities. In ALLEA's view,
fundamental research has to be supported for two important reasons: In the first place for scientific knowledge's intrinsic relevance. Fundamental research, be it in sciences or in the humanities, augments the general body of knowledge, which is an intrinsically valuable and precious quality of civilisation, and an essential condition for the creation of the next generation of scientists. Through its scientific enlightenment of the general public, it can even be regarded as an important instrument with which to develop and strengthen a society's intellectual defensibility and democratic foundation.

But there is also a second justification: its instrumental relevance, its contribution to a society's economic and technological development and social welfare. ALLEA fully agrees with the Commissioner's views that stimulation of research and development is one of the crucial conditions for the realisation of the Lisbon objectives. Europe will only achieve competitiveness and leadership in the global market if it takes the lead as a knowledge economy and society. The development of knowledge - and especially new knowledge - is a sine qua non for the future of Europe.

Basic or applied?

The distinction between basic and applied research is less clear-cut than is often suggested. There is a great deal of overlap between the two spheres. It is, for instance, increasingly difficult to identify parts of sciences that do not affect technology, or that are not themselves affected by technology. Methodologically, too, there is nothing wrong with applied research: it follows the same rules and standards as basic research, and has quite frequently resulted in important theoretical scientific breakthroughs. But there is a difference in orientation. Science starts with curiosity, the wish to know the causes of and reasons for observables and the desire to find scientific explanations for what is not yet understood. In fundamental research, these unanswered questions present themselves in experimentation, reflection and scientific discussions; they are science generated. In applied research, though, these questions are offered by practical problems in industry, society or government. Its origin as well as its goal is therefore different, it is problem and solution oriented.

As was already indicated in the previous section, I would like to submit that science-driven research is essential, not only for the augmentation of academic knowledge, but also for the stimulation of economic growth and social welfare. It is indeed a misconception that fundamental, science-driven
research only serves the academic goal of augmentation of knowledge, and that it is not auxiliary to, let alone pre-conditional for important technological and industrial innovations. Many striking examples can be given to prove this point, although it did, admittedly, some time before certain discoveries reached the practical application stage: Maxwell's groundwork on the transmission of electronic waves resulting in Marconi's telegraph some decades later, the development of the fundamental Radon theory that lead to computer topography (60 years later!), modest 1920's polymer chemistry eventually being applied in the manufacturing of plastic, fundamental physiological research that lead to significant innovative pharmaceutical remedies, the invention of the transistor finding its use in the semiconductor area, and - to give a striking recent example - the development of a device with which to exchange large data files by a few physicists working at CERN, thus sowing the seeds of the World Wide Web, which is mainly responsible for the information and communication branch's enormous prosperity .... they are all cases in point. As mentioned, Europe's economic and social future depends on the careful development and exploitation of its knowledge base. Innovation in a knowledge economy requires new knowledge, and new knowledge is specifically generated by cutting edge, science-driven research. Stimulation of the latter is an important means of becoming a winner in a worldwide knowledge-based economy.

Of course, fundamental research is fairly unpredictable and risky if judged by its technological utilisation. Not all fundamental research leads to suitable applications, and technological innovations are often unintended by-products of research (serendipity). But, as is always the case when dealing with the probabilities of very valuable outcomes: one has to take some false positives for granted in order to continue having a chance of capturing a big prize.

It goes without saying that applied and instrumental research, leading to direct industrial and technological applications as well as strategic research - *i.e.* fundamental research that supports the building of a strong European capacity in areas relevant to Europe's strategic needs - is also indispensable for the realisation of the ambitious Lisbon targets. In other words, we need substantial support for targeted research, and therefore welcome the fact that there is a fair degree of continuation of the 6th FP as far as the themes of co-operative research are concerned, but we particularly welcome the importance assigned to frontier research, and the proposal to create a fund for science-driven research, as well as an agency to manage this fund.
European Research Council

As was specified in the previous section, ALLEA joins almost all individual and institutional representatives of the European scientific and scholarly world in strongly supporting the proposal to stimulate excellent frontier research by creating a European Research Council tasked with supporting investigator-driven, fundamental research of the highest quality in a strongly competitive mode, with applications evaluated by international peer review. The principle of allowing a researcher in any of the European states to compete with all others on the basis of excellence presents a new definition of European added value and is an improvement on the one used hitherto, which merely entailed collaboration by research teams in different European countries.

There is, furthermore, overall agreement among European science organisations that central European funding of the ERC is needed, and the proposal within the 7th Framework Programme to reserve part of the funding for this purpose is greatly appreciated. However, there is also consensus that to ensure its acceptance, integrity and effectiveness, the ERC needs to be modelled on the principle of self-governance, thus reflecting the established and well-proven National Research Councils model in many countries. The ERC should operate as an independent body, and its governing Council of Scientists should not be an advisory body, but integral to the ERC in terms of policy setting, and decision making.

We believe that the ERC has to dispose of a budget commensurate with socio-economic expectations: in the order of the larger national research councils’ budgets (i.e. between €1.5 and 2 billion per annum). The size of the annual budgets of the USA’s National Science Foundation ($5 billion) and National Institute of Health ($28 billion) indicates what it takes to make a continent-wide impact.

Trans-disciplinarity

A major discussion theme at this conference concerns the fact that many salient problems in society and industry, to whose solution scientific research might provide a significant contribution, are of such a complex nature that the traditional mono-disciplinary approach would only result in limited analyses and partial solutions. It is debatable whether we could loosen
ourselves sufficiently from the traditional mono-disciplinary ties of our research approach, funding and training of students. At most European universities, research and education still occur primarily along the lines of Mode 1, as described by Gibbons, Limoges, Nowotny, Schwartzman, Scott & Trow (1994). Mode 1 knowledge production is described as disciplinary, homogeneous and its scientific orientation as basically structural/nomothetic. The Mode 1 scientific climate is hierarchical and tends to preserve existing forms of research and teaching, the organization of which is guided by internal control systems. Problems are set and solved in the context of the research community's traditional academic concerns. By and large, traditional research councils and funding bodies operate pretty much according to the rules of Mode 1.

Of course, this Mode 1 type research has obvious merits: a strict methodological discipline, building upon an accepted and well defined scientific tradition, fertile interaction with like-minded colleagues, and meticulous testing by peers. Mode 1 type research has also resulted in an impressive body of scientific knowledge and has led to important breakthroughs and discoveries. Nevertheless, we currently know that many scientific phenomena straddle the borderland between two or even more disciplines, and that a thorough understanding of these phenomena requires more than one discipline's input. Biophysics, brain and behaviour, molecular biology, psycho- and sociolinguistics, neural networks and environmental research are exemplary cases in point.

This need for trans-disciplinary research is even more striking in the areas of applied, problem-induced research. As mentioned above, many salient problems that could gain from a scientific analysis, are not concerned with disciplinary borderlines, and would benefit from a multi- or trans-disciplinary approach. Think of the interactions between agronomy and farming cultures, between health and environment, between health, transport and migration, between informatics, logic and language, between demography, economics and health care, between energy and (sustainable) consumption, and a great many others.

In respect of our research design, it could therefore well be that we have to allow for more thinking along the lines of Mode 2, which is described as trans-disciplinary and more heterogeneous in terms of methods and approaches. In its problem orientation, Mode 2 recognises the subjects of research's complexity and contextualisation, and allows for a variety of data-gathering methods. Moreover, problems are set and solved in the context of application and societal translation. The scientific climate is heterarchical,
involving more transient forms of organization, funding sources are more diverse, and quality control also involves social accountability.

In the FP7 proposals, some attention is paid to special priority areas that cut across themes. However, ALLEA believes that FP7 should more overtly encourage an inter- or multi-disciplinary approach. The examples given in Annex I, p.12 regarding marine sciences and technologies are quite meagre, whereas the proposal should have seized the opportunity to really expand and elaborate the theme of trans-disciplinarity, given the importance of this theme as indicated above.

Science: risk or saviour?

The Eurobarometer revealed another, more disturbing finding: many Europeans consider themselves poorly informed on issues concerning science and technology, resulting, as is suggested, in a more sceptical perception of science and technology. This is particularly found among women, older people and those with a lower level of education. With respect to ethical concerns, we see the classical paradox: on the one hand people express fear of scientists, whose high degree of knowledge may make them too powerful, and also harbour concern that scientific research could cross ethical boundaries, while, on the other hand, they want scientists to work freely without the fear of risks and potential dangers slowing them down, since they believe that scientific progress will be beneficial for their present and future life.

Not all criticism against science is objectionable. Some of the captious questions posed to present day scientists are amendable to reason and there is still no final conclusion on whether Homo Sciens, who has appropriated much of the divine power of the time, is capable of handling that power in a responsible manner.

It is here that insufficient and unfair communication about research and its results come home to roost (see also Drenth, 2005). Some researchers focus too emphatically on the policy and practical implementations of their research, also when this is not warranted. Other scientists give their opinion on political and social issues, wrongfully suggesting that their words are scientifically justified, while there may be no empirical evidence available, or not at their disposal (for instance, because it is not their field of expertise). Others again claim too much success and promise results too quickly in order to acquire financial support for their research, to obtain public honour, or to
secure an appointment or promotion. Sometimes the public is simply misled for political reasons: the general and unjustified resistance against genetically modified food, or against nuclear fission are cases in point. Scientists should never let themselves be misused for political purposes. There is a case to be made that wrong communication about research is always harmful. It creates too much hope (particularly in connection with medical research), and, sometimes, unjust fear (technological and information developments). And, if the research results fall short and fail to fulfil the claims, they boomerang on science in general.

It is clear that a furthering of public awareness through the dissemination of scientific information, an honest dialogue with the general public, the promoting of a scientific and educational culture in Europe, and placing responsible science at the centre of policy making are actions that have a high Community added value and that could be important stimuli for the greater acceptance of science by society.

The FP7 proposal envisages 'Science in Society' actions taking place along three lines: (1) the embedding of the theme throughout the 7th Framework Programme (through the introduction of social/ethical themes and communication strategies in the content and operation of the FP's various components), (2) defining of and focussing on a number of core themes at the interface of science and ethics, and (3) the co-ordination of national programmes and policies tailored to social/ethical issues in science and technology.

ALLEA considers this a fruitful and effective approach. It particularly wants to emphasise the importance of embedding a social/ethical view in regular projects and programmes. The objectives of ensuring public confidence in European research and its applications, of strengthening the scientific workforce and providing better career opportunities in science, and of developing trust in and appreciation of science through various policy-related initiatives and well monitored communication can best be achieved through the integration of 'science in society' throughout the 7th Framework Programme, and not (only) by focussing on underpinning research with a dedicated budget, although the latter can, of course, be ill spared. ALLEA welcomes the over-proportional increment of the budget reserved for this purpose. Given the projected ambitions and the growing importance of science and society's new partnership in Europe, it considers this development fully justified.
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Section II
Science and Ethics
Introduction

I was invited to take part in this symposium as president of ALLEA. ALLEA stands for All European Academies, which is the European Federation of National Academies of Sciences and Humanities. The creation of such an international, in this case European association of Academies was a logical consequence of the internationalisation of research and scientific collaboration, and of the increasing tendency to lift the discussion and decision-making on science policy and science implementation to a supra-national level.

Internationalisation of science

Science has grown from an individualistic to a collective, collaborative activity. At present science cannot grow in isolation. It presupposes cooperation and contact, exchange of knowledge, expertise and research results. Of course, these contacts have to cross national borders. The term 'national science' has become almost a contradiction in terminis.

The international nature of science and scholarship has always been apparent, symbolized by the many 'international' scholars in the 16th and 17th century (Erasmus, Keppler, Huygens and Descartes a.o.), who travelled widely and published for an international public (in Latin, of course), and by the frequent exchange of scholars and scientists between the various European Academies in later centuries. But the global perspective of science has become particularly manifest to date with the explosive developments of fast and easy electronic communication means. Many research themes have an international character and cannot be studied from a purely national perspective (environment, health and infection diseases, transport, trade, migration, tourism). For a number of mega-programmes single national funding falls short of what is needed and only combined efforts can furnish the necessary means (CERN, EMBL, SO). Moreover, collaboration and collective efforts can strengthen the competitiveness of the higher level

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gremium (e.g. Europe), a basic argument for Commissioner Busquin to promote the 'European Research Area' (ERA), with a complementary character and added value vis-à-vis the national research programmes.

But a last, and in connection with the theme of this symposium certainly not the least argument is that of international solidarity. International scientific collaboration should also be defended on the grounds of a moral obligation of the western and economically more advanced countries to support and strengthen R&D capabilities in economically less developed countries. The stronger countries have a world wide responsibility to assist the countries that are in less favourable conditions and with relatively weak R&D resources to help them to further enhance their research and development capacities. This may often take the form of assistance (aid and support) in stead of collaboration (mutual benefit), but in the longer run they may become stronger partners. And there is no doubt that in the very long run such aid/collaboration is the best precondition for peaceful coexistence and economic balance in the world, and is thus beneficial for everyone, including the presently stronger (western) partners.

Academies of science

Academies are full and active partners in this international scientific collaborative orb. Also for the role and contribution of Academies the rule holds that the whole is more than the sum of the parts: a European association, such as ALLEA, intends to be more than the sum of national Academies in Europe.

The idea of a transnational association of Academies is not new. Already in 1787 Johann Gottfried Herder stood up for a united German Academy that transcended the local Academies of those times. Later German Academies joined their research efforts in a Kartell, since the requirements of an important research programme (Enzyklopädie der mathematischen Wissenschaften, and Thesaurus linguae latinae) exceeded the available resources of any singular Academy. In the first 'International Association of Academies' in 1899 many European Academies united: the German Academies of Berlin, Göttingen, Leipzig and München, as well as the Academies from London, Paris (Académie des Sciences), St. Petersburg, Rome and Vienna. One non-Europian Academy joined, the American NAS. One year later the Academies of Amsterdam, Brussels, Budapest, Oslo, Copenhagen, Madrid, Stockholm and Paris (the two other Academies within
the 'Institut') joined. From this agglomerate and by a politically complicated roundabout way the two most significant international scientific organisations emerged: the *Union Académique International* (UAI) for the humanities, and the *International Council for Science* (ICSU) for the natural sciences.

In Europe new opportunities for co-operation arose in the 1990’s, due to the end of the Cold War and the increasing significance of the European Union in the area of science and higher education. Initiated by the Académie des Sciences, the Royal Society, the Royal Swedish Academy and the Royal Netherlands Academy ALLEA was officially constituted in 1994. ALLEA’s members are the national Academies of sciences and humanities. It now has members from all over Europe, from Iceland to the Georgian Republic, from within the European Union and beyond. ALLEA exchanges information and experience among Academies. In ALLEA the national Academies collaborate to serve the scientific community, European political organisations and the general public. Committees and working groups focus on science and ethics, intellectual property rights, privacy in the information society, research strategies in smaller countries and other issues related to science and scholarship in Europe.

In spite of differences in scope and actual realization Academies share a number of common roles and functions; more specifically: (1) communication (exchange of scientific views and information, meeting and discussion forum), (2) research promotion (originally their primary task, and after having become 'societies of scholars' indirectly still a central responsibility) and (3) the advisory role. It is particularly in the context of this third role that Academies should be concerned with fair-play practices and societal and ethical aspects of science.

**The advisory role of Academies**

Although the advisory function was not always explicated in academy-bylaws many Academies have considered it as their responsibility to convey judgements on the basis of their scientific insights to governments, institutions or the public at large. Also monarchs have acknowledged the usefulness of science for the promotion of trade and commerce, and prestigious Academies like the *Royal Society of London* and the *Académie des Sciences* have carried out a good deal of applied research. Leibniz was very disturbed by the fact that *Leopoldina* restricted itself to pure and
fundamental research, and the *Brandenburger Sozietät*, which he founded in 1700, explicitly included the application of science for the benefit of the state in its objectives.

Later the Academies were confronted with an advisory role, often in an informal way, but sometimes also explicitly prescribed by law or regulations. This is possibly the most challenging, but at the same time most controversial role of an Academy. What kind of advice can be distinguished? We would like to distinguish between four categories of advice:

(1) Advices, based upon quality assessments. One may think of advices on continuation, termination or adaptation of certain lines of research, programmes or projects, or of the appraisal of individuals or research groups for the endowment of scholarships or prizes. Also, the recent tradition of calling in assistance of visiting committees for the evaluation of departments, faculties or whole institutes Academies can play an important role. Furthermore, the advices with regard to the planning of future research should be mentioned as they are concerned with trends and developments in various scientific disciplines, both at the national and international level, and which could be used by the government or other relevant institutions for the development of a science policy for the future.

(2) Advices regarding science policy, such as the desired balance between pure and applied science, between natural sciences and humanities, and between scientific research and science education. Also advices regarding the content of certain institutionalised forms of organization or financing of scientific research in the country, or advices on curricula of graduate research schools and career opportunities of young scientists fall within this category. Finally this category includes advices on the prioritising of research areas for funding within the realm of the national strategic research policy.

(3) Advices on political decisions, based on scientific research. Some of these advices have a medium or longer time perspective (global change, energy, system of medical care, TV and violence, peace and détente, world population). Others have a more immediate or acute character (BSE, mouth and foot disease, radiation of mobile phones, earthquakes). For some of these advices abundant and solid knowledge is available and needs only 'translation'. For others only incomplete, probabilistic and uncertain knowledge is available, which must lead to a different type of advice (more constrained or more in terms of expected risks and probabilities) or no advice at all, depending on the nature of the issue and the chances and effects of both positive and negative errors.
(4) Advices on ethical and societal questions related to or generated by scientific research. Since this specific aspect of the Academies' advisory role precisely concerns the theme of this symposium, we will give some attention to the relationship between science and ethics in the next section.

**Ethical and societal issues**

With respect to the ethical and societal questions of concern to Academies of sciences and humanities we can make a first distinction between internal and external problems.

The category of internal ethical problems in science all have to do with (im)proper behaviour of scientists. It is only recently that the academic world has developed concerned interests and has taken a more formal stand in this matter (see for instance NAS, 1995, and KNAW, 2000). Also ALLEA (Drenth, Fenstad & Schiereck, 1999) and ESF (ESF, 2000) have asked attention for the importance of proper ethical conduct and best practices of scientists. We can distinguish the following subcategories of improper scientific behaviour:

- Unethical behaviour, including fraud (fabrication and falsification of data), deceit (deliberate use of improper analytical or sampling techniques, inaccurate or selective rendition of a colleague's results, etc.) and infringement of intellectual property rights (plagiarism, pinching of a colleague's ideas or discoveries).
- Improper or imprudent behaviour *vis-à-vis* subjects, including not taking full account of the requirement of informed consent, insufficient observation of the need for anonymity or protection of privacy, open or hidden discrimination, and negligence of the duty to exercise the greatest care in animal research.
- Careless behaviour with respect to the general public and the media, referring to too optimistic or unjustified popular reports and interviews, negligence in cases of misquotation by the press, taking no action in cases of wrong or biased interpretation by colleagues or in popular media.
- Disregarding 'good practice' rules, such as justified authorship (only in case of a contribution to the publication), proper sequence of authors (according to significance of contribution, and if not alphabetical order, etc.), proper citation, correct dealing with confidentiality, secrecy or delay of publication in the interest of the 'sponsor', avoiding conflict of interests (*e.g.* in evaluative or editorial role).
Science can no longer be seen as an isolated, value-free process. It is embedded in the context of values, interests and political objectives, and as such subject to ethical and societal norms. If we refer to external ethical problems that a scientist may encounter, we have in mind this broader political-societal context of the scientific pursuit. One may think of for instance:

- Justification for the choice of the subject of research: Is it worth knowing what they pursue? This question is important not only for the researcher personally, but also, since often contract or taxpayer's money is involved, for the sponsor or public in general.
- Is the research sufficiently independent from 'interested' parties, be it administrative heads, governments, or sponsors? Research results should be absolutely uncontaminated and free from external influence or pressure. This requirement is especially important in sponsored or contract research. Of course, contract research can be independent, unbiased and in perfect agreement with the scientific rules, but it cannot be denied (and there is unfortunately ample evidence) that 'He who pays the piper calls the tune'.
- Responsibility for what is being done with the research results and by whom. Research results can be used for better or for worse and it is unfortunate that they are sometimes being used irresponsibly. Of course, this misuse does not have to be carried out by the scientist who did the research; it could be politicians, legislators, businessmen, army generals and many others. It would also be inappropriate to refrain from doing research in case it might possibly be abused. That would almost certainly mean the end of all research, because nearly all research results are in principle open to wilful abuse. The question is however to what extent the scientist remains responsible for what is being done with his or her research. Fortunately there is a growing awareness that this responsibility does not stop at the door of the laboratory or research institute.
- Ethical problems generated by the research itself, for example research on stem cells and embryo's, research on new and potentially dangerous viruses, research on nuclear fission and fusion with unknown outcomes, research on xenotransplantation, and others. The point here is that the progression of the purely scientific and technical developments may go faster than the reflection on their ethical and moral implications. An interesting question here is when and where to call for 'no go' or 'slow go' decisions because of these ethical arrears.
As far as the advisory role is concerned, and in particular with regard to the ethical and societal questions, we touch upon an interesting and important issue, namely the supposed primacy of scientific objectives for an Academy. Is not veracity the main touchstone of its activities?

In our view that is true, but it would be a major mistake to derive from this presupposition that scientists, and Academies of science, do not carry moral and societal responsibility. True, scientific practice is inconceivable without the freedom to think, to speak, to carry out and to communicate about research. If science is unable to retain its independent and impartial nature, it will sooner or later become irrelevant and useless. But at the same time there is the - in recent years increasing - need for public accountability. Scientists nowadays are confronted with a variety of ethical, social and political questions which cannot be pushed aside with the argument that they are normative and not scientific. The challenge for scientists and Academies of science in the future is therefore not to make a choice, but to find a balance between freedom and responsibility.

Are Academies equipped for such an advisory role? The following elements make out a good case for an affirmative answer. First, there is the attainability of abundant scientific knowledge and experience within their walls. Second, Academy members are (should be) 'disinterested' in the proper sense of the word: in an ideal case no political, economic, regional or professional interest group can nourish the hope of being especially favoured by an Academy's advice. Third, these members have a firm scientific orientation, and emphasize the free and uncontaminated nature of science. They are independent and there is little danger that they would turn into another political pressure group.

However, whether Academies will also become a major advisor in ethical, social, and legal matters, as described above under 3 and 4, depends on the willingness of the Academies to take the moral and societal accountability of science seriously - which, in turn, depends on the willingness of their members to accept this responsibility - and on the public's willingness to assent to such a role for the Academy. For the latter condition it is important that (1) an Academy should truly represent the world of (top) science, including the voices of the younger, and the female scientists, and (2) also the expertise outside an Academy should be mobilized, for instance through its participation in advisory committees and working groups.
A final word

Finally some observations in the light of the events on the 11th of September 2001. The conclusion that science is truly international leads to the sequitur that also the choice of the optimal balance between freedom and responsibility should be dealt with in a global context. And what has happened on the 11th of September 2001 has added a new dimension to this freedom and responsibility. In this connection I would like to submit the following:

- Academies should offer their assistance to fight and prevent terrorism. This could lead to reallocation of time, energy and financial resources for the study of the nature and the determinants and consequences of this phenomenon.
- Academies should also take part in the public debate by offering their insights and knowledge about chances and risks of terrorist weaponry, including nuclear, chemical and biological instruments, aiming at helping governmental decisions and possible reducing public anxiety.
- Targeting scientists from Islamic countries and the exclusion of certain Islamic countries from knowledge is both ineffective and unacceptable. No prohibition for scientists from these countries to attend scientific gatherings should be allowed, in accordance with the ICSU doctrine on universality of science requiring free speech, contacts and travel for all scientists.
- More intensive collaboration with scientists from Islamic countries could help to further insights in possible philosophical and cultural differences between 'western' and Islamic scientific approaches. Such collaboration could contribute to a better understanding and to building bridges between two cultures.

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Freedom and Responsibility in Science: Reconcilable Objectives?

Hamburg, 2001*

Introduction

Science and scientists operate in a field of tension with two poles: freedom and responsibility. On the one hand science cannot exist and grow without freedom. Scientific practice is inconceivable without the freedom to think, to speak, to carry out and to communicate about research. Only facts, and all the available facts, should speak; only the logical, analytical norm should rule. Science should be unfettered and free from external pressures, be it from tradition, ideology, religion, or political or financial interests. If science is unable to retain its independent and impartial nature, it will sooner or later become irrelevant and useless.

On the other hand there is the - and in recent years increasing - need for public accountability. Scientists are nowadays confronted with a variety of ethical, social and political questions that cannot be pushed aside with the argument that they are normative and not scientific. Ethical and socio-political questions arise with respect to the choice of research areas and topics, to the nature of experimentation and gathering data, and to the question of what will be done (and by whom) with the research results afterwards.

In this paper we will argue that the scientist's freedom to investigate, to define and to follow his/her own rules and criteria on the one hand, and the scientist's duty to acknowledge the danger of irresponsible complacency and to shield science from the insulation from its ethical and political consequences on the other, are important prerequisites for the value and the contribution of science. Although at first sight the objectives freedom and responsibility may seem to contradict and therefore exclude each other, we will maintain that they can be reconciled and can both be pursued at the same time.

The evolution of the issue

In ancient days a good deal of the power to be derived from knowledge rested in the hands of an omniscient God, and the way that power was exercised was not always liked, but never distrusted. Later, science has appropriated much of the knowledge and has placed this source of power in the hands of scientists and scholars, who in their enthusiast search for knowledge, have opened wide horizons and surprising perspectives.

But there came also critique. Not everyone is convinced that these scientists and scholars can handle their power and deal with it in a responsible manner. Critics hesitate over the awareness of scientists of the ethical ramifications of knowledge and the moral implications of scientific discoveries.

For quite some time positive scientists have incurred risks of accusations of superbia, by developing an ivory tower attitude, in which any accountability for human and social effects of scientific research is repudiated: "Science is about how things are, not about they should be". Since a few decades, however, the question of science and values has once again been high on the agenda. Attacks on the autonomy and sovereignty of science have come from various sources:

First of all there was the anti-establishment movement of the 70's, in which the political-scientific reflections of authors like Marcuse, Adorno, Habermas, and Holzkamp became popular and were notably embraced by the critical student activists and (often junior) staff. Their criticism contributed to the dismantling of the arrogant misconception that freedom of science is equivalent to a negation of societal responsibility.

A second attack resulted from the economic recession in many Western countries in the 80's, which led to reduced public and private funding for research. Quantity and quality of research became important criteria for survival in the often serious cutbacks in research personnel. This challenged another miscomprehension of scientific freedom, as the license to freely think, meditate, and explore without caring much about output or quality.

A third assail on the scientific and academic freedom came from the cry for 'utilization' of science at the end of the 80's and the 90's, to be heard both in governmental and industrial circles. It was argued that scientific goals should be made subordinate to those of economic and technological development, and that criteria such as utility, applicability and economic relevance should be given priority over pure scientific standards.
Considerations of societal and technological relevance for funding research even penetrated the policy of many national and international research councils, the long-term defenders of pure and fundamental research. It is ironic to see that basically the principles of the Neo-Marxist movement of the 70's and those of the industrial utility orientation of the 90's coincide: *les extrêmes se touchent!*

In the fourth place it has to be said that in recent years also within science itself the question as to whether science is autonomous and value-free or value-bound has received ample attention. We will present a more detailed discussion of this issue in the next section, relying a good deal on an earlier exposé I presented in Drenth (1999a).

**Science: value-free or value-bound?**

The question phrased in the heading of this section has become an important issue during the last few decades, although the opinions still diverge. As I observed at a conference of ALLEA (the European Federation of National Academies of Sciences and Humanities) on the subject European Science and Scientists between Freedom and Responsibility (Drenth et al, 1999): On the one hand it was defended that scientific knowledge is value-free and has no moral or ethical connotation. Science tells us how the world is, whether we like the story or not. Basic research is driven by academic curiosity and not by the hope or probability that it will be put to practical use. Ethical and moral issues can only rise when science is applied and it produces usable objects. But the latter is technology. Technological objects or processes can be used for better or for worse. Science produces insights, ideas, knowledge. These are in themselves neutral and can only be corrupted if mixed with political, social or economic or other non-scientific aims.

On the other hand, there is a different view that does not accept the assumption that science should only be concerned with producing reliable knowledge thus making it value-free. The following grounds and arguments for this position can be brought forward:

- It is a elemental obligation of all scientists and scholars to reflect on the paradigmatic presumptions and the socio-historical entrenchment of their scientific efforts. This reflection is, in itself, a meta-scientific and value-embedded phenomenon. We must realize that our conceptualisations and models are always abstractions of reality, and that only an approximation - or 'reconstruction' - of reality can be achieved.
Recently the distinction between fundamental science on the one hand and applied science and technology on the other has become less clear-cut. There is a good deal of overlap between the two spheres, and it is increasingly difficult to identify a part of science that does not affect or is not affected by technology. In this light reserving 'value free autonomy' for science and 'value bound dependence' for applied science and technology is no longer tenable.

Increasingly scientists deal with a social, political or psychological reality that is fundamentally affected and changed by the scientific findings: health, safety, communication, environment, privacy, peace, mobility, economic development, and many other social objectives of great value are radically influenced by modern science, and many ethical or socio-political problems result directly from the advances of scientific research. Scientists should be aware of this and should anticipate the changes they work, and the problems they induce.

Even if scientists refrain from actually suggesting political or ethical choices, and restrict themselves to presenting probabilities and risks connected with certain options, this is not value-free. Risks involve values and normative choices, and these have to be faced by the scientist; one may think of the modern medical research (genetically determined diseases) or environmental research (climate and global change). Further questions may be: Risks for whom? How far does the right to know go? What is the balance between self-determination and the interests of larger groups or the society as a whole? How certain does the scientist have to be before warning, especially in the case of irreversible developments?

Scientists cannot avoid the meta-scientific question whether or not it is worth knowing what they pursue. It has to be justified - if only for him or her personally, but often, since taxpayer's or sponsor's money is involved, also publicly - why scientific issues need to be addressed. This justification implies, in essence, non-scientific choices and decisions.

It seems fair to conclude that in scientific research on the one hand objectivity has to be maintained in spite of the pressure from ideological movements, industrial lobbies, governmental strain or political pressure groups. On the other hand it has become increasingly difficult to separate the functions of producing knowledge and making value-bound choices in extending research findings to the public. In this respect it may be useful to draw a distinction between science as a product, the accumulated body of knowledge, and science as the process of knowledge accumulation. The former, knowledge as such, which was refereed to by the Swiss philosopher
Bochenski (at the Engelberg Forum, 1990) as *Wissenschaft als Inhalt* is morally neutral and solely subject to methodological-scientific norms. However, this does not apply to the latter, which Bochenski referred to as *Wissenschaft als Tätigkeit*. This is subject to ethical and political norms, which have bearing upon the choice of hypotheses to be researched, the manner in which data is gathered and experiments are conducted, and accountability for what is ultimately done with research data (Drenth, 1993).

Our conclusion is that research is embedded in the context of values, interests and political objectives. Rather than denying this, or retreating to the safety of the ivory tower, the scientists does well to realize this and to take the appropriate responsibility seriously.

**The impairment of freedom**

In the previous section it was shown that for *Wissenschaft als Inhalt* the freedom to formulate and adhere to its own laws and criteria is absolute essential for its raison d'être. Without this freedom science will sooner or later become irrelevant and useless. Let us have a look at the factors that spark and fuel the impairment of this freedom.

In the first place the pressure of powerful individuals or institutions, which are ill-disposed towards or even strongly opposed to the possible outcomes of the research. This is probably the most dangerous and far-reaching form of influence. Opponents try to prejudice the researcher and to influence the results, or, if that is impossible, to obstruct a proper analysis or due publication, or even to prohibit the research all together. Historic examples range from the Roman Catholic pressure on Galileo to review his heliocentric cosmology to the fundamental Christian and Islamic resistance against the theory of evolution, and from Stalin's pressure on the biologist Lysenko to distort biological facts in order to comply with Communist Party agricultural policies to the opposition of the 'nurture' lobby in psychology to the analysis of genetic determinants of human behaviour in the 70's.

Secondly economic and financial interests. Competition and marketing interests in the pharmaceutical research, or in technical studies which may lead to lucrative patents can have a strong influence. Economic interests undoubtedly played a role in the premature marketing of the drug thalidomide with disastrous consequences for a number of pregnant mothers and unborn babies. Fear for losing financial support moved NASA to send a space shuttle into orbit without sufficiently checking possible computer
deficiencies and with the well known tragic outcome. Both military importance and financial constraints have led to insufficient and inadequate safety studies in Chernobyl-type nuclear power plants, leading to the largest non-military nuclear disaster ever. In a recent upsetting report Deyo et al. (1997) reveal how the pharmaceutical lobby has assailed medical researchers who were critical of research that supported the quality of a number of drugs, turning these researchers into defendants, intimidating them and discouraging others from taking up similar lines of investigation. Similar assertory attempts are known on the part of the tobacco-industry vis-à-vis researchers demonstrating the disastrous health effects of smoking.

In this connection a warning against the almost unlimited growth of contract research within universities is in place. More and more universities and research institutes tend to (have to) rely on assistance from private, external funding for the financing of their research. Of course, contract research does not necessarily imply an encroachment on the scientific freedom and autonomy. In principle contract research can be independent, unbiased and can follow perfectly the scientific rules. But it cannot be denied that it may suffer from the overriding temptation to avoid biting the hand that feeds you. In a recent publication Köbben and Tromp (1999) have given ample demonstration of the inclination of contract researchers (under real or putative pressure) to produce 'favourable' results.

A third potential corrupting force is the own ambition of the scientist, enforced by vanity, desire for fame and recognition, chances of personal profits and career opportunities or other personal motives. Let me be clear: there is nothing wrong with scientific ambition as such, or with tenacious belief in own ideas or hypotheses. Without these drives probably no groundbreaking discoveries would be made, nor Nobel prizes rewarded. However, there are too many tragic examples throughout history of science indicating that the craving for scientific honour and fame can push the scientist beyond the ethical borders and can lead to fraud and faking of data.

Socio-ethical constraints

It has become clear that freedom of research is a sine qua non for proper and integer scientific practice. But, as has been indicated as well, science can also be seen as Tätigkeit, and in this perspective freedom cannot be defended at all costs. Scientists should also realize their ethical and societal responsi-
bility. Let us now discuss some of the constraints on science which follow from this responsibility (see also Drenth, 1999b).

Point of discussion is whether there are social or ethical constraints to be imposed on science; in other words whether there is a need for 'no-go' or 'slow-go' decisions on the ground of social and ethical objections. 'No-go' means that the research in question is wholly unacceptable. Examples may be attempts to make human-ape hybrids, applications of germline genetic manipulation to enhance intelligence, and human cloning for procreation. 'Slow-go' would apply in instances where results should be temporarily suspended until the ethical implications have been subjected to public discussion, and, preferably, reasonable consensus has been reached. This area may include cases in which we have insufficient knowledge to appreciate and, thus, control the consequences of our research (see McLaren, 1999).

It should be realized that any discussion of the constraints to be imposed on research is fraught with danger. Throughout history we find too many examples of scientists having been repressed and their research having been stifled because the results were not consonant with the ruling ideologists, did not favour with powerful authorities, or were opposed to the interest of influential movements and action groups. Even if these movements have fully respectable objectives, such as equal rights for women, environmental protection, anti-discrimination, and peace, infringement of the right to investigate because of political unacceptability of outcomes to external groups is utterly dangerous.

We further like to assert that it would be wrong to refrain from doing research into a given problem in case it might possibly be abused or be applied irresponsibly. This would virtually be the end of all research, since nearly all scientific results are in principle open to wilful abuse. An additional problem of constraining research on the grounds of potentially undesirable or dangerous consequences is that such consequences are not always manifest on beforehand. Particularly outcomes of fundamental and innovative research are often surprising and hard to predict. So it is difficult to derive the constraints directly from the nature of the results.

It follows from the foregoing that is not easy to identify the ethical constraints that would be incontestable for scientists and the general public. They should refer to basic and peremptory values that would be imperative for scientists and responsible citizens alike. At the above mentioned conference of ALLEA the following principles have been discussed and accepted:
(1) Research is not justifiable if, before, during or after the experiment or the gathering of data unacceptable damage is inflicted upon the object of research or its wider environment (social environment, society, nature). This applies to all objects of research, whether they be people, animals, nature or culture.

(2) Research is not justifiable in cases where the nature or the consequences of the research are in conflict with basic human values. These values include in any case:
   a) respect for human dignity, which guarantees the autonomy and freedom of choice of all individuals, informed consent prior to participation in research, and the rejection of every intent to commercialise the human body;
   b) solidarity with mankind, which guarantees regard and acceptance of fellow human beings on the basis of equality;
   c) solidarity with posterity, which embodies the broader responsibility for sustained development of a planet that is to be left to future generations.

**Limits to responsibility**

May I finally pose a similar caveat as I expressed at the recent opening ceremony of the European Academies' Science Advisory Council in Stockholm (June 11, 2001), arguing that there is also a limit to the moral obligations of scientists. They should adhere to their scientific trade, and should not take over the responsibility of politicians, employers, doctors and educators, nor become another pressure group in the political arena. They can present careful analyses of problems at hand, they can indicate probabilities and risks of certain outcomes, they can denounce biases and prejudices, they can show that there is no statistical justification for certain fears or hopes......, but they should not take over the responsibility from the actual decision makers. It is not up to the physicist to decide whether or not nuclear energy should be exploited. It is not up to the virologist to determine immigration restrictions for possible carriers of contagious diseases. It is not up to the behavioural scientist to decide whether euthanasian termination of life should be allowed to deeply depressed, incurable patients. If we would not recognize these limits we would ask too much responsibility of scientists, and as Lewis Wolpert once said (Wolpert, 1989), it would give too much power to a group who are neither trained nor competent to exert it.
Conclusion

In this paper I hope to have demonstrated that in science freedom and responsibility are not irreconcilable, and can and must be pursued at the same time. The challenge, therefore, is not simply to make a choice between the two, but to look for a balance, that sufficiently permits the realization of both incontestable objectives.

References


Integrity in Science: A Continuous Concern

Brussels, 2003

Introduction

At present research organisations, universities and academies are placing scientific integrity in the spotlight. And rightly so, as I hope to illustrate in this paper. Scientific integrity should and must be a continuous concern to all of us!

This applies notably to academies of sciences and humanities. Besides their task of promoting science by means of lectures, discussions and the exchange of people and ideas, and conducting of high-quality research in their own institutions or through research programmes under their auspices, academies also have an important advisory role to play. Issues bearing on ethical and social questions as they relate to scientific research occupy a special place in the domain of this advisory task.

This is not to say that the advisory role is limited to problems related to integrity. The following may serve as a guideline: The advisory task of an academy could have bearing on the following four types of problems:
- advice based on quality evaluations (of people, institutes or programmes),
- advice pertaining to questions of science policy (areas that need stimulus, the balance of natural sciences and the humanities, the fundamental-applied research balance etc.),
- advice in respect of political decisions to which scientific knowledge could make a contribution (global change, epidemics, crime, immigration),
- advising with regard to social/ethical issues that are linked to or generated by scientific research.

Within this fourth category of ethical problems in science we get to deal with what I have previously denoted (Drenth, 2002) as internal and external ethical problems. The external category of problems refers to questions such as:
- What justifies the choice of the research topic? Is it worth knowing what we investigate?
- Is scientific research truly sufficiently independent (of clients, interested parties, sponsors)?

* Address to the Flemish Academy of Medicine, Brussels, October 2003.
- How far does the researcher's responsibility extend in respect of what is being done with his results?
- Is there a need for 'no go' or 'go slow' decisions in certain cases on the ground of ethical objections to implications or consequences of insights generated by the research? One thinks of stem cell research, xenotransplantation, research into dangerous viruses, nuclear fusion or fission etc.

Internal social/ethical problems in science all refer to undesirable or unacceptable behaviour by scientists. The following are relevant:
- negligent behaviour in regard of human or animal research subjects,
- careless or inaccurate communication with the general public and the media,
- disregard of the rules of good practice when publishing, quoting and evaluating research, and
- violation of the norms of scientific integrity.

The next part of this paper shall concentrate on this type of internal unethical behaviour - the violation of scientific norms of integrity.

**Trust**

Trust is the most important pillar on which science rests. Colleagues should be able to rely on the honesty of a researcher; honesty in describing the phenomena (s)he observes, in reporting how these have been analysed and interpreted, and in proper referring to other publications in the field. This applies also - and perhaps more so - to society in general. Users and interested parties (clients, patients, businesses, and social institutions) are far less able to verify the correctness and the quality of the conclusions and insights that the researcher presents than fellow researchers. If other scientists and the public at large can no longer give this trust, this would sooner or later mean the end of the usefulness and relevance of science.

How does science currently fare in respect of trust? On answering this question we encounter a curious paradox: On the one hand there is much - to the point of irresponsible - trust in science. Do dangers lurk through damage done to the ozone layer, depletion of fossil energy, reduction of the biodiversity, illnesses as a result of smoking, drinking, unsafe sex...? Science will no doubt present a solution, is often the carelessness incurring, but misplaced optimistic thought.

On the other hand, we also encounter an increasing scepticism. This manifests itself in the increasing interest that various pseudo-scientific
theories, such as astrology, psychokineties, neurolinguistic programming and telepathy enjoy, as well as in the growing popularity of unscientific, sometimes occult, practices such as reincarnation therapy, homeopathy, laying on of hands and hypnosis. Alarmingly, paranormal observations of UFOs, aliens and extra-terrestrials, corn circle makers and voices of the dead, too, are taken seriously by many. Even anti-scientific sounds are only too often heard from newspapers and other media, with scientific researchers being depicted as sly Mephistos or Frankensteins who eagerly and disrespectfully tinker with the secrets of life through their cloning or genetic manipulation.

How can one explain this growing scepticism and anti-science attitude? Firstly we could point to science's changing social position. Science has also encountered the currently applicable and justifiable need for public justification. Through this disclosure, inadequacies come to light - vulnerability being the price to be paid for transparency. Furthermore, society does not always sufficiently appreciate that science is an evolving process in which improvements of insights, adjustments of previous conclusions, and a continuous specification of contingencies are part of normal practice. Statements and conclusions of researchers can thus often be contradictory. Thirdly, in the empirical sciences, scientific assertions very often have a probabilistic character. This probability is either ontic (much random variation in the object), or epistemic (too many gaps in our knowledge, measures that are too unreliable). Society, however, wants certitude and does not know how to handle probability statements that are mistaken for doubt or ignorance.

Let us concede, however, that the negative attitude in respect of science has also been prompted by honest concern and even fear. Over the years a good deal of the power to be derived from knowledge has been transferred from an omniscient God to the scientists and scholars. But have they proved capable of using this power in a responsible way? The blessings of scientific research are, of course, manifold. But do we not perceive, at best unintentional, dangerous consequences of scientific research? Nature, peace, the sharing of affluence, health, privacy... have they all really done well in the current explosion of scientific knowledge?

But not to a small extent this anti-scientific movement can also be blamed on the scientific researchers themselves. They do not handle the media well, are vague or arrogant, don't sufficiently differentiate between personal opinions and scientific results, are careless in respect of animal experiments, or with human research subjects, cite incorrectly, argue about the sequence
of authors' names.... or, most harmful of all, violate the norms of scientific integrity. More and more cases of fraud, swindling and plagiarism seem to be making headlines these days. The harm that each of these cases does to science cannot easily be overestimated.

**Scientific misconduct**

Hard data on the occurrence of scientific misconduct are rare and also difficult to get hold of. Not only are researchers and their managers reluctant to hang their dirty laundry in public, but also is the line between bad or sloppy research and true misconduct not always clearly drawn, as we shall see below. Utter discretion is furthermore required; a scientific reputation is quickly harmed - harm that is very difficult to undo and that often proves to be 'fatal'.

And yet, as mentioned, an increasing number of unacceptable cases have recently been reported in the press: in my country there were the cases of a neurologist who fabricated data for an experiment that was paid for per case, of a psychologist who used reams of text from an American colleague's work without citing him, of a biochemist who went to the press with insufficiently tested hypotheses on the treatment of Aids patients, of an environmental researcher who was forced to adjust certain for the sponsor disagreeable conclusions. Prior to this, authors such as Van Kolfschooten (1993), and Hulspas and Nienhuys (1997) had already unmasked a substantial number of cheats and swindlers. In one of his columns, the Dutch oncologist Borst speculated that while "out and out fraud' does not occur very frequently, tampering with data does. He compared this to lower back pain - it is there but difficult to prove.

Inevitably, cases of scientific fraud have also been revealed in other countries and, it would seem, lately in growing numbers. Thus:

- last year *Nature* and *Science* comprehensively covered the infamous case of the fraud of a group of cancer researchers at the Max Delbrück Centre for Molecular Medicine in Berlin,
- two years ago (13 September 2001) *Nature* examined a number of shocking cases of the theft of ideas by journal reviewers,
- the *Times Higher* (2704-01) revealed that at least 19 review articles published in the highly esteemed *New England Journal of Medicine* had been written by researchers who had secret financial links to the pharmaceutical companies that had brought the examined medicines on the market,
at a recent conference of the Office of Research Integrity (ORI), a unit within the American government's Department of Health and Human Services, a number of case studies were presented, including the dramatic case of the Research Triangle Institute in North Carolina, where there had been a veritable 'epidemic of falsification'; employees simply fabricated whole batches of data,

- last year we were startled by two cases of fraud in very highly esteemed institutes: in the Lawrence Berkeley National Laboratory in California data had been concocted to reveal the discovery of a new element (element 118), and in the famous Bell Labs a similar case of data fabrication was reported to have occurred (the Schönland scandal, see Physics World, June 2002),
- Denmark is involved in a conflict involving the environmental researcher, statistician Lomborg, who seems to approach, and some would say cross, the permitted margin of the selective use of data in his book 'the Sceptical Environmentalist' (Nature, 16 January 2003),
- recently Nobel Prize winner Rolf Zinkernagel's Institute of Experimental Immunology at the University of Zürich was accused of the manipulation of data (Nature, 20 February 2003),
- the New England Journal of Medicine withdrew a submitted article, since a number of the co-authors were unaware that "their" article had been submitted, and
- a few years ago this same journal described how the pharmaceutical industry lobby applied undue pressure on researchers who were intending to publish data that it found unwelcome (Deyo et al., 1997).

The above is a selection from the generally known cases of scientific misconduct, but, as Borst indicated, the fear that unnoticed far more fiddling with research data occurs, does not, unfortunately, seem unfounded. Apart from that, it should be pointed out that scientific misconduct is a universal phenomenon that has always occurred. Descartes was accused of the plagiarising Snellius and Beekman, and Darwin of 'borrowing' ideas from his fellow countryman Wallace. Even Einstein was accused by the mathematician Hilbert of stealing his ideas on the theory of relativity (an accusation that has, incidentally, been recently disproved by the Max Planck Institute in Berlin). Pons and Fleischman claimed success with the so-called cold fusion, which could never be confirmed, and Cyril Burt concocted his high correlation between twins' intelligence test scores to support his heredity hypothesis. Sometimes it was just a matter of stubbornness: Pauling defended vitamin C's ability to heal cancer despite all empirical evidence to the
contrary, the Russian Fedjakin kept believing in his polywater and the Frenchman Blondot in his N-radiation.

The nature of scientific misconduct

Thus far we have more or less lumped all forms of violation of scientific integrity together. In truth, however, we cannot tar them all with the same brush. What exactly do we mean when we talk about scientific misconduct? Anyhow we can distinguish the following three categories (see also Drenth, 1999):

- First of all, fraud: This includes the fabrication of data, the falsification of data, the 'trimming' of the data (rounding off favourably, omitting undesirable data), and the selective use of data. In short, fraud implies tampering with data or with the presentation of data.

- In the second place, deceit: This pertains to the deliberate violation of the rules of the methodically sound analysis and processing of data. For example, the suggestion that empirical data are available, when this is not true, gross negligence in sampling, deliberately chosen improper but 'favourable' analysis techniques, and the deliberately incorrect or selective rendition of others' research results or conclusions. With deceit a colleague or reader is therefore explicitly lead up the garden path.

- Thirdly, infringement of intellectual property right: The best known example is plagiarism - the deliberate presentation of others' ideas, findings, research results or texts without acknowledgement or reference, as if they were those of the author him- or herself. But there are also other forms: the pinching of ideas from a doctoral student or colleague, claiming to be the sole author of research to which others had contributed, and a journal editor or reviewer claiming the thoughts or ideas originating from a reviewed (and rejected) article.

Two observations should be made at this point.

- Not all violations are equally serious. There is variation in the seriousness of misconduct both between and within the mentioned categories. The fabrication of data is more serious than 'rounding off' or making use of a too small sample. Plagiarising substantial pieces of text is more reprehensible than pinching an idea from a conversation between colleagues.

- Secondly, the border between unacceptable and (still somewhat) acceptable behaviour is not always easy to indicate. Where do you draw the line between verification on a too small sample and the illustration of an
argument with 'case' data? Where lies the boundary between plagiarism and careless citation? Was an incorrect, but 'favourable' statistical technique truly chosen deliberately? Is it scientific fraud or a different methodology or even paradigm?

**Causes**

To answer the question of what causes or fuels this corruption of science, three types of causal factors come to mind: Firstly the pressure from powerful persons or institutions that resist honest scientific analysis, because they are ill disposed towards or even strongly opposed to the results thereof. Historical examples vary from the Roman Catholic pressure on Gallileo to revise his heliocentric conclusion to fundamentalist Christian and Muslim opposition to the theory of evolution.

Secondly, economic and financial motives. Economic interests in research into new medicines, technological innovation or patent-directed research can be substantial and can exert such unwarranted pressure. Here too recent history offers a series of striking examples, varying from the thalidomide tragedy to the subversive activities of medical researchers in the service of the tobacco industry, and from the Chernobyl disaster to the exploded NASA explorer. At this point it is perhaps appropriate to utter a word of warning in respect of contract research to universities and research institutes that are subsidised by the government. Research within universities and large institutes is increasingly dependent on contracts with industry, the government or interest groups. In principle this needn't be wrong. It is quite possible for contract research to be independent and unbiased and to be executed strictly according to scientific rules. But there is most certainly the danger of a tendency to curry favour with the client (even if merely to secure a continuation of the research). The English expression 'he who pays the piper calls the tune' is apt indeed. In their book *De onwelkome boodschap* (The unwelcome message) Köbben and Tromp (1999) reveal through a host of examples that this danger is far from unfounded.

Thirdly, the researcher's own ambition may not be omitted; an ambition fed by vanity, the desire for fame and recognition, and the prospect of personal gain. In itself scientific ambition is not reprehensible. Neither are tenacity and strong belief in one's own views or hypotheses. Without such motivations probably no important discoveries would be made nor Nobel
prizes awarded. But here we refer to a dysfunctional craving for scientific fame that leads to behaviour that crosses the limits of what is admissible.

**Prevalence and prevention**

As previously stated, there is not much to say about the frequency with which scientific misconduct occurs. Hard data on this subject are almost non-existent. We have also indicated that it is a universal phenomenon of all time. Yet, it is not unlikely that misconduct is on the increase. First of all for statistical reasons. The enormous increase in the number of researchers will also inevitably lead to an increase in the absolute number of misconduct cases and the resultant negative press reports. But there is more: (especially young) researchers are under mounting pressure to achieve, to record results, to deliver output, to have articles published and to be cited. Tenure appointments, membership of research schools, research fellowships of academies or national research organisations, subsidies and grants, promotions and professorships - for all these desirable aspirations one needs research results and publications, preferably spectacular ones. Add to this the above-mentioned (real or perceived) pressure from sponsors of contract research and it will be clear that a dangerous climate in which scientists are tempted to engage in unacceptable behaviour arises.

Then the second word in the title of this section: prevention. Various procedures and rules are being devised in our country and others to cope with the dangers of scientific misconduct, as well as to develop proper procedures when such misconduct is suspected. Protocols, ombudsmen, confidants, science courts of arbitration and appeal, and various kinds of sanctions are suggested, all of which are very noteworthy and useful. But of the essence is the development a matured scientific conscience and a basic sense of responsibility of the researcher him- or herself. This is of vital importance. And the development and nurturing of these values and responsibilities, rather than the fear of sanctions or the risk of being caught, will enable science to fight and prevent misconduct and fraudulent activities.

**The Academy’s role**

Finally, what role could an Academy of Sciences play in this? Above it was mentioned that this problem most certainly concerns the academy in its
advisory role. In a modest survey among the European academies, all ALLEA members, almost common consent was expressed with an academy's vigilant, informing and often even judiciary responsibility. Also a recommendation of the European Science Foundation (2000) envisages an important task for academies in the formulation of national codes of good scientific practice and in the initiating of discussions on the most suitable national approach to this problem.

Obviously a good few things are already occurring which have been implemented or initiated by academies. The American National Academy of Science has published a superior brochure 'On being a scientist' (NAS, 1989, 1995 2nd edition), the KNAW (Heilbron et al., 2000) in The Netherlands produced a booklet a few years ago that not only described the rules of good practice, but also presented a number of real or imagined (but realistic) cases of ethically unacceptable behaviour or ethical dilemmas, to be used as discussion material for the training of researchers. Many European academies have developed or published a Code of Science, or function as an advisory board or science court in ethical cases.

Yet some co-ordination within Europe would be useful without this meaning that uniform rules and procedures need to be developed for all European countries. With this purpose ALLEA has adapted a recommendation by the Royal Netherlands Academy of Arts and Sciences (Notitie wetenschappelijke integriteit), translated it into English and offered this Memorandum on Scientific Integrity for the perusal of all ALLEA's member academies. This Memorandum urges the founding of a National Committee for Scientific Integrity (NCSI) that can serve as an advisory board or science court of appeal in those cases of violation of scientific integrity where the settlement by the (primarily responsible) management of the institute or university is found to be unacceptable to one of the relevant parties. In The Netherlands such a body (LOWI) has been founded by the Royal Academy in close consultation with the National Science Foundation (NWO) and the Association of Universities (VSNU). We keenly await its first activities. It is not ALLEA's intention to have this formula exactly copied by other European countries, but by offering this model it aims to stimulate the discussion on the most desirable approach, to stipulate a possible helpful role of Academies of Science, and, if possible, to co-ordinate a European approach to the phenomenon of scientific misconduct that can be so injurious for science.
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Trust in science

Trust is the most important pillar on which science rests. Colleagues should be able to rely on the honesty of a researcher; honesty in describing the phenomena (s)he observes, in reporting how these have been analysed and interpreted, and in proper referring to other publications in the field. This applies also - and perhaps more so - to society in general. Users and interested parties (clients, patients, businesses and social institutions) are far less able to verify the correctness and the quality of the conclusions and insights that the researcher presents than fellow researchers. If other scientists and the public at large can no longer give this trust, this would sooner or later mean the end of the usefulness and relevance of science.

How does science currently fare in respect of trust and acceptability? The latest results of the Eurobarometer (2005), a European survey of attitudes and opinions, show a few disturbing findings: Firstly, many Europeans consider themselves poorly informed on issues concerning science and technology. This is particularly found among women, older people and those with a lower level of education. Secondly, many people express even fear of scientists, whose high degree of knowledge may make them too powerful. They also harbour concern that scientific research could cross ethical boundaries, which is difficult to control.

Here we encounter a somewhat paradoxical demeanour (see also Drenth, 1999). On the one hand people expect science to solve most of the current and future problems and to improve their living conditions; this especially to be found within the economically and technologically less developed European countries. They also want scientists to work freely without the fear

* Elements from a paper presented at the Conference The responsible conduct of basic and clinical research, Ministry of Science, Ministry of Health, Polish Academy of Sciences, Warsaw, June 3-4, 2005; a paper at the Budapest World Science Forum on Knowledge, ethics and responsibility, 20 November 2005; and a paper at the ALLEA Standing Committee on Science and Ethics Workshop The ethical commitment of scientific and scholarly academies, Swiss Academy of Humanities and Social Sciences, Bern 1-2 December 2005
of risks and potential dangers slowing them down, since they believe that scientific progress will be beneficial for their present and future life.

On the other hand, we also encounter an increasing scepticism. This manifests itself on the one hand in a tendency to turn away from science, and an increasing interest that various pseudo- and para-scientific theories and methods, such as astrology, psychokinetistics, neurolinguistic programming and telepathy enjoy, as well as in the growing popularity of unscientific, sometimes occult, practices such as reincarnation therapy, homeopathy, laying on of hands, theta healing, and hypnosis. Alarmingly, paranormal observations of UFOs, aliens and extra-terrestrials, corn circle makers and voices of the dead, too, are taken seriously by many.

We see even a more aggressive reaction and anti-scientific notes in newspapers and other media, with scientific researchers being depicted as sly Mephistos or Frankensteins who eagerly and disrespectfully tinker with the secrets of life through their cloning or genetic manipulation.

Interestingly enough, it not ignorance that is to be blamed: There is no (negative) correlation between knowledge of and (dis)trust in science. This means that just more information about science as such does not suffice to solve the attitudinal problems.

Many of these negative attitudes and sentiments are fed, in part, by fear; fear of a lack of control over the possible effects of scientific developments: nuclear waste, environmental deprivation, the horrific consequences of genetic modification, emerging dangerous viruses and bacteria, loss of liberty and privacy through ICT developments, and fear, perhaps also, of a dominant scientism and secularisation, and deprivation of religion and spirituality. The Eurobarometer findings show also that it is not purely technophobia and risk aversion. There are serious concerns and doubts about the moral and ethical consequences of the fast developing science and technology.

Granted, not all criticism is objectionable. Some of the captious questions posed to present day scientists are amenable to reason and need careful attention. Are scientists always aware of the potential and/or ethical consequences of their research, especially when this is applied and used by others? Are scientific practitioners capable of judiciously dealing with new-found knowledge? Have scientists sufficiently freed themselves of unwanted intrusion of influence? Have they protected research subjects against the infliction of unacceptable harm and exposure to unacceptable risks? Questions and criticisms like these cannot be arrogantly ignored by science. If not given serious attention, they may erode the axiomatic quality of science and even
pose a threat to science as an intellectual endeavour. Moreover, since these attitudes may influence the general public, they may also have an unfortunate effect on the willingness of political leaders to reserve the necessary funds for innovative and frontier research. It goes without saying that public opinion, the sentiments of voters and the tone of the media debate largely determine the boundaries imposed on scientific practice at the beginning of the 21st century. And, as said, these sentiments are unmistakably more sceptical and negative than in the past.

Academies of sciences and humanities and other scientific organisations and agencies have to give this issue of public opinions and sentiments with respect to the impact and societal consequences of science and technology a higher priority than they have done in the past. Fortunately we see various signs that these insights start to break through. For instance, the European Commission, in its proposals for FP7, intends to further public awareness through the dissemination of scientific information, an honest dialogue with the general public, the promoting of a scientific and educational culture in Europe, and placing responsible science at the centre of policy making. These actions are considered to have a high Community added value and to be important stimuli for the greater acceptance of science by society.

The FP7 proposal envisages ‘Science in Society’ actions taking place along three lines: (1) the embedding of the theme throughout the 7th Framework Programme (through the introduction of social/ethical themes and communication strategies in the content and operation of the FP’s various components), (2) defining of and focussing on a number of core themes at the interface of science and ethics, and (3) the co-ordination of national programmes and policies tailored to social/ethical issues in science and technology.

ALLEA considers this a fruitful and effective approach. It particularly wants to emphasise the importance of embedding a social/ethical view in regular projects and programmes. The objectives of ensuring public confidence in European research and its applications, of strengthening the scientific workforce and providing better career opportunities in science, and of developing trust in and appreciation of science through various policy-related initiatives and well monitored communication can best be achieved through the integration of ‘Science in Society’ throughout the 7th Framework Programme, and not (only) by focussing on underpinning research with a dedicated budget, although the latter can, of course, be ill spared. ALLEA welcomes the over-proportional increment of the budget reserved for this purpose. Given the projected ambitions and the growing importance of
science and society’s new partnership in Europe, it considers this development fully justified.

**Communication**

It was said above that just more insight in science is not a prevention of the grave concerns about its consequences. But at the same time incorrect and unfair communication about research and its results definitely aggravates the problem. Some researchers focus too emphatically on the policy and practical implementations of their research, also when this is not warranted. Other scientists give their opinion on political and social issues wrongly suggesting that their words have a scientific justification; there may not be empirical evidence available or not at their disposal (for instance, because it is not their field of expertise). Again others claim too much success and promise too quick results, in order to acquire financial support for their research, to get public honour, or to secure an appointment or promotion. Sometimes the public is simply misled for political reasons: the general and unjustified resistance against genetically modified food, or against nuclear fission are cases in point. Scientists should never let themselves be misused for political purposes. It can be defended that wrong communication about research is always harmful. It creates too much hope (particularly in medical research), and sometimes unjust fear (technological and information developments). And, if the research results fall short and fail to accede the claims, they boomerang for science in general.

There is another problem that has to be discussed with respect to the communication of scientific results to the general public and decision-makers. With respect to many and often pressing questions and problems in society much of our knowledge is probabilistic, uncertain and contingent, because of either ontic (really existing in the world out there) or epistemic (insufficient and lacking knowledge) uncertainties or both. And it is a serious mistake to communicate this ‘probabilistic’ knowledge to the public and to policy makers as if we were certain about the insights and conclusions. We see the negative effects if we do: confusion and suspicion at the cost of the credibility of scientific research.

Anyway, it has become clear that scientists must develop abilities to communicate their findings and ideas with policy makers at all levels and with the public at large. The public needs to be informed how and why their taxes are being spent. As a recent ESF report (2003) states: “Given that the
public sector is the principal sponsor of research there is an increasing onus on all of us to devote more time to explaining, listening and debating’.

This issue is also of considerable concern to Academies of sciences and humanities, and, for that matter, for associations of such academies, like All European Academies (ALLEA). The latter has, therefore, created a Working Group on Science and the Media with the task to advise ALLEA and its member Academies on the question how to deal with this increasingly important aspect of the work of scientists and scholars, i.e. the proper communication with the general public through the various types of media, each with its own singularity and each requiring a specific approach.

However, it would be unjust and too easy to interpret all ethics issues in science in terms of (mis)communication. There are substantial problems related to the very nature of the scientific endeavour or as a result of lack of integrity of the scientist. Let us have a further look into the nature of the connection between science and ethics, following a distinction between external and internal social/ethical problems, which I made in an earlier publication (Drenth, 2002).

**External social/ethical problems in science**

The first category of problems refers to questions of the social/ethical context as well as the consequences of scientific research. Questions such as the following arise: what is the justification for the choice of a research topic? Is what we intend to investigate, worth knowing? This question is a matter of the researcher’s personal preference and values, but, as said, in many cases also of importance to the taxpayers or sponsors.

Is the scientific research truly independent of sponsors, employers, clients or other interested parties? We know that scientific research should be independent and free from any external pressure or influence. But all too often – and this is especially true for sponsored or contract research – there is an overriding temptation to avoid biting the hand that feeds.

To what extent is the researcher responsible for what is done with the results? Research results can be used for better or for worse. They can turn into a blessing for individuals or society, but there are also many cases in which researchers sadly observe their research being abused by colleagues, practitioners, or the media.

Are there cases in which ethical objections to certain implications of research, or certain consequences of new insights are becoming too strong?
Sometimes scientific and technological developments’ progression is faster than the reflection required on their societal and moral implications. In the medical field cloning, genetic cancer research, embryonic stem cell research, xenotransplantation and others are cases in point.

An interesting question is whether governments or science organisations (funding agencies or academies) should opt for ‘no go’ decisions with respect to certain subjects or fields of investigation. In discussing the constraints to be imposed on science, I would like to assert that in general it would be inappropriate to refrain from doing research for fear that it might be abused or be irresponsibly applied. This would almost certainly mean the end of all research, because nearly all scientific results are, in principle, open to wilful abuse. An additional problem related to constraining research on the grounds of potentially undesirable or dangerous consequences, is that such consequences are not always easy to foresee, especially in fundamental and innovative research. After all, one of the characteristic features of such research is that its results cannot be predicted or charted beforehand. Surprise is typical of creativity and serendipity.

It is further important to realise that any discussion of the constraints to be imposed on research is fraught with danger. History abounds with examples (Galileo, More, Spinoza, Lysenko) of science having been repressed because its research results did not find favour with the ruling ideologists, or did not serve the economic or political authorities’ interests, or were opposed to the interests of (sometimes wholly respectable) movements and action groups, such as feminism, the anti-discrimination movement, environmental activists, and the freedom movement.

Of course, there are cases for which ‘no go’ decisions would be regarded incontestable by all scientists and scholars. Cases in which unacceptable damage is inflicted upon the object of research (people, animals, nature, culture), or cases in which the nature or consequences of the research would be in conflict with basic human values (human rights, human dignity, informed consent, equality and non-discrimination).

Maybe more room has to be made for ‘slow go’ decisions. These would apply in cases where scientific or technological developments are out of step with the ethical reflection on their impact and consequences. The research could be temporarily suspended until the ethical implications have been subjected to public discussion, and reasonable consensus is reached (see McLaren, 1999).
Internal ethical problems

Internal ethical problems all refer to scientists’ improper behaviour. This category encompasses: improper or imprudent behaviour with respect to subjects of experimentation, such as the insufficient protection of privacy or anonymity, neglecting to obtain informed consent, discrimination, improper treatment of experimental animals etc., improper dealing with the general public and the media, including too positive and too optimistic reporting of research results, which would create too much unjustified hope, especially in medical research, disregarding rules of ‘good practice’, such as undeserved authorship, improper citation, no sequence of authors according to contribution, or alphabetical order if contributions are equal, violating the rule to avoid conflict of interests (in a review task for publication or subsidy) etc., manipulation of data or interpretation, including fraud (fabrication or falsification of data), deceit (deliberate violation of methodological requirements, for example with regard to sampling and statistical techniques, so as to create a false confirmation of hypotheses, or otherwise biased results), and infringement of intellectual property rights, such as plagiarism, or pinching of a colleague’s discovery, or a student’s idea.

Of course, not all violations are equally serious. The manipulation of data is the most severe of these violations, but there is also variance within the categories. Fabrication of data is more serious than ‘rounding off’ or making use of a too small sample, while plagiarising substantial pieces of text is more reprehensible than pinching an idea from a conversation between colleagues.

Hard data on the occurrence of misconduct are rare and also difficult to obtain. Part of the problem is that it is not always easy to draw a clear line between unacceptable and (still somewhat) acceptable behaviour. Where lies the boundary between experimental ‘proof’ based on a too small sample and the illustration of an argument with ‘case’ data? Or between plagiarism and careless citation? Was an incorrect, but ‘favourable’ statistical technique truly chosen deliberately? Is it selective use of evidence, or a different methodology, or even another paradigm?

The number of reported cases in scientific and public media is, however, growing. For instance *Nature* has revealed a alarming number of cases of misconduct in the last few years. “Fraud booms worldwide” headlines *Times Higher* 5 August 2005. Even more disturbing is that the fear that far more fiddling with research data occurs unnoticed, does not, unfortunately, seem unfounded. Three years ago, an issue of *Nature* (vol. 418, 8 August 2002)
discussed a report that the American Institute of Medicine (IOM) had just released and that specifically dealt with scientific integrity and scientific misconduct. The IOM also noted that fully-fledged cases of scientific misconduct are rare, but that smaller lapses often go unnoticed: fudging a control here, deleting a messy data point there. But the IOM warned that what might appear to be minor violations of integrity, will have bad long-term consequences. It called for research institutions to take a more active role in creating an environment in which misconduct will not occur.

Causes of misconduct include pressure from powerful institutions or persons (governmental or church leaders), economic and financial motives (lending an ear to industrial sponsors, the risks associated with contract research), and the scientists or scholars’ ambitions and vanity. Given the pressure on researchers to produce publishable output and to show (preferably spectacular) results, a present-day growth of misconduct is certainly more than likely.

As far as the prevention of misconduct is concerned, different kinds of corrective measures (punitive measures, sanctions) or preventive measures (procedures, regulations, precepts, whistleblowers, ombudspersons) have been proposed, but every right-minded person must agree that most important is the development of a scientific conscience, and a proper sense of values and standards. Fostering such a conscience, particularly as part of the education of the younger generation of scientists, will be a major commission of universities and learned societies.

What role should Academies play?

What role could academies of sciences and humanities and umbrella academy organisations, such as All European Academies, play in this matter? After all, academies have an important advisory role. Moreover, the ethical issues in general, and most certainly the problems concerning scientific misconduct, are of real concern to the academies.

At ALLEA’s General Assembly in Prague in 2000, I reported on a modest survey of ALLEA members that addressed these problems. Four questions were asked: Is scientific misconduct a serious and growing problem in your country? Is there a formal procedure or protocol to deal with these problems in your country (the role of the Academy)? Is there a need for a prescriptive code of ethical conduct, or good manners in science? What role could ALLEA play in these matters?
The reactions varied, but in general scientific misconduct was seen as a growing concern. Often there was no official procedure or protocol, and the leadership of the relevant institute handled the matter. Sometimes academies were involved in an advisory or evaluative capacity. The general reaction to the question on the need for a code of conduct was affirmative; in certain cases such a code was already available. Almost all ALLEA members (with the exception of one or two who only acknowledge the problem as a country-specific matter and not a universal one) welcomed the idea of ALLEA taking some initiative or role in the further development or promotion of a 'code for good manners in science' in Europe.

Many academies have already developed such a prescriptive set of rules, a code of conduct and/or a procedure for handling reported cases of misconduct. The NAS publication ‘On being a scientist’ (1995, sec. ed.) is both well known and well written. In 1998, the Deutsche Forschungsgemeinschaft issued Proposals for safeguarding good scientific practice as a reaction to a disturbing case of collective fraud. In December 2000, the European Science Foundation issued a policy briefing on this issue under the title ‘Good scientific practice in research and scholarship’ (ESF, 2002), in which, among others, it was recommended that:

- National academies should draw up national codes of good scientific practice in research and scholarship where these do not yet exist; and
- National academies should initiate discussions on the most appropriate national approach to procedures for investigating allegations of scientific misconduct, whether by means of an independent national body, formal procedures at each university and research institution, or by other means.

It should be clear that this does not only concern purely national problems, although culture and traditions, as well as legislation may have an influence on the way these problems are handled in practice. The issues in question are, however, generic and universal, and also need an international approach. This is why I have urged (intermediate) international Associations of Academies, such as ALLEA, USNAS, the Federation of Asian Scientific Academies of Science, the African Academy of Science and others to become actively involved in the co-ordination of the various approaches undertaken nationally in co-operation with world-wide organisations such as IAP, ICSU, TWAS and UNESCO.

In fact, they can play a role by specifically: placing the issue of misconduct on the agenda, providing individual national academies with information and advice, co-ordinating national activities inter-nationally with a view to alignment around common principles (although not disregarding differen-
ces of opinions and legal traditions between states), and dealing with misconduct in international research projects.

In this vein, ALLEA has tried to take up responsibility for the coordination at a European level, without this implying that uniform rules and procedures need to be developed for all European countries. ALLEA (2003) adapted a recommendation by the Royal Netherlands Academy of Arts and Sciences (Notitie wetenschappelijke integriteit, KNAW, 2001), translated it into English and has offered this ‘Memorandum on Scientific Integrity’ for the perusal of all ALLEA’s member academies. This Memorandum urges the founding of a National Committee for Scientific Integrity (NCSI) that can serve as an advisory board, or a science court of appeal when the (primarily responsible) institute or university’s settlement in respect of the violation of scientific integrity is found to be unacceptable to one of the relevant parties. In The Netherlands, such a body (LOWI) has been founded by the Royal Academy in close consultation with the National Science Foundation (NWO) and the Association of Universities (VSNU). It is not ALLEA’s intention to have other European countries copy this formula exactly, but by offering this model, it aims to stimulate the discussion on the most desirable approach and to point out the potential helpful role that Academies of Science could play. Furthermore, it aims, if possible, to co-ordinate a European approach to the phenomenon of scientific misconduct that can be so detrimental to science.

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Scientific Values: How Universal?

* Athens, 2004 *

Introduction

Throughout history there has been an intense interconnection between science and philosophy on the one hand and morale and ethics on the other. This interconnection is cognate with the interdependence of the ancient Greek concepts *episteme* - scientific knowledge - and *phronesis* - its prudent use and wise application. It is, therefore, proper for a conference on the universality of moral and ethical values to provide scope for the universality of scientific values. And as President of the Federation of European Academies of Arts and Sciences I feel honoured to have been invited to address this issue. As mentioned, the distinction between universalism and culturalism can be traced to Greek philosophy, and was an important issue in the Athenian philosophical debate. Plato defended the viewpoint that morals are based on the knowledge of universal ideas, and therefore have a universal character. Aristotle argued that ethical rules should always be seen in the light of the traditions and accepted opinions of the community.

In the course of history both points of view have been supported. A few centuries ago, under the influence of Kant and Locke, the universal view was prevalent. In later thinking, following the philosophy of, for instance, Hegel and Herder, the cultural view became more popular. Herder rejected the Enlightenment idea of a universal civilisation all together, and thought that each culture was in some way unique. This tendency towards the universal view has become even stronger under the influence of the current large-scale migration that is occurring both within Europe and into Europe, mainly from developing countries in Africa and Asia. Consequently, modern societies, more than ever before, have a multicultural character, which may generate conflicts and antagonisms, but which can also lead to a demand for cultural tolerance and an appreciation of diversity. Whatever the case may be, it confronts us with the controversy of the universality versus the cultural-specificity of norms and values.

There are two distinct aspects with respect to the universality of scientific values. The first refers to the scientific norms as such, and deals with one of
the basic issues in the 'science of science', namely the question whether we
can presuppose the universality of analytical and conceptual laws in science,
or whether the methodological and epistemological framework in sciences is
culture-bound and therefore not universal. The second aspect concerns the
interaction between science and ethical values. The question may be raised
whether science is autonomous and value-free, or whether it is subject to
normative constraints and limits, and therefore not value-free. If the former is
correct, the issue of the universality or culture-boundness of ethical norms is
not relevant. If, however, the latter view would be adhered to, the question
may be raised whether such ethical norms and constraints are universal and
generally valid, or culturally determined and differing across cultures. Both
questions will be addressed briefly in the following exposé.

Universality of science

Many regard the universality of natural science laws as the fundamental
advantage of science and the driving force of its development. The laws of
physics and chemistry or life sciences, often expressed as mathematical
formulas - the real scientific *lingua franca* - are applicable everywhere, and
scientists from all over the world can participate in the scientific discourse.
In fact, it is considered foolish for scientists not to take part in such
discussions, since this is the only way for science to progress and for
individual scientists to develop.

I would even submit that such collaboration almost always creates a better
understanding of common goals. Where there are differences in approach or
methods, collaboration will lead to a greater sensitivity to and, often, a
greater appreciation of such differences in approach. It can even contribute to
the mitigation and prevention of conflicts between nations, notably in two
ways.

In the first place by the persuasive power of scientists' belief in rationality
and rational solutions as well as by their tradition of coping with conflicts by
agreeing to the rules of rational decision making. These include a proper
definition of the question, agreement on the methods to be used, a logical
analysis of the arguments, the evaluation of the adequacy and sufficiency of
the data supporting these arguments, the resolve to collect additional
information, if necessary, and, then, to postpone definitive conclusions until
further evidence has been acquired.
A second factor that contributes to conflict resolution or prevention is the required attitude of openness and collaboration and a need to communicate in the search for the truth. Currently, collaboration and contacts have to cross national borders more than ever before. Science cannot exist and develop in isolation. It presupposes the exchange of knowledge, expertise and results and requires a genuine attempt to understand and criticise others’ work. Even during the darkest moments of the Cold War there was still scientific contact between the scientists of the Soviet block and those of the Western world. I am convinced that active dialogues between scientists of countries in conflict help to build bridges of trust between countries.

Let me repeat my remark in reaction to the recent terrorist attack in Madrid in my Presidential address at ALLEA’s general assembly in Brussels: All indications point to fanatic and fundamentalist Islamic cells being responsible. But the creation of a mistrustful atmosphere vis-à-vis scientists from Islamic countries or the exclusion of certain Islamic countries from the scientific discourse is not only ineffective but also unacceptable, as stated, for example, in the ICSU’s doctrine on the universality of science. On the contrary, more contacts and more intensive collaboration with scientists from Islamic countries could help to further insights into possible philosophical and cultural differences, and could contribute to a better understanding and trust. Science and scholarship are the vehicles par excellence for building bridges between cultures.

To avoid being misunderstood let me state that this does not mean that the universalism of scientific laws also generates universalism of morality and ethical norms as the Positivistic savants envisaged, and this most certainly does not mean that progress in the development of such universal science is linked to progress in humanity. Recent history offers plenty of examples to contradict this supposition.

But does this ideal of the universality of science apply to all sciences? What about the sciences in which culturally determined institutions and culturally determined behaviour are the objects of research? Two notable cases in point are the social and behavioural sciences. It is often argued that in these sciences the object of research, which is per definition determined by culture, can never be analysed by methods and conceptual systems that are independent of the culture that causes the variance in the phenomenon being researched.

I can provide a number of examples from my own research interest: cross-cultural psychology. Cross-cultural analysis of behaviour or performance in non-Western cultures often confronts the researcher with the restrictions of
the theories and instruments developed in the West. There are phenomena for which no real expressions are available outside the culture concerned; for example the Japanese ringi-sei mode of decision making, Latin American machismo, or the Dutch phenomenon of the polder model. In some cultures, relationships that are considered to be generally valid are not found, such as the relationship between participation and the effectiveness of decision making, or the connection between financial incentives and work performance. It is furthermore obvious that the saliency of certain research topics is culturally determined: cultural diversity is particularly important in immigration countries, dyslexia is more relevant in literate cultures, and the issue of national versus supra-national identity more relevant in countries within the European Union. The researcher also discovers that the practicability of certain research instruments is culture-bound: paper and pencil tests cannot be used in primitive cultures, nor speeded tests in cultures where precision is more important than quantity, questionnaires in cultures where there is pressure to give socially desirable or politically correct answers, or interviews in 'face saving' cultures.

The question is, then, whether we have to understand cultural specificity against the background of universal and generic theories and methods (which is called the 'etic' approach), or whether this behaviour can only be understood within its cultural context, and therefore requires culturally specific theories and concepts (which is called the 'emic' view). In keeping with this latter view, a demand for indigenous psychologies has emerged: an African, Chinese, Indian etc. psychology besides the Western or Euame-
rican psychology. The examples of culturally specific topics and research instruments mentioned above encouraged some cross-cultural psychologists to support the latter approach. Many theories and methods thus seem to be susceptible to cultural differences and to demand a cultural contextualisation.

But introducing the cultural context for a real understanding of the behaviour is not paramount to a drastic 'indigenisation' and differentiation of psychology. The need for differentiated and separate conceptual frameworks and theories for specific cultures leads to serious epistemological problems. Why, for instance, should this requirement apply only to large, well-defined cultures, and not to very specific and unique subcultures as well? Why to America versus Asia, and not to Northern versus Southern Italy or Norway, city versus countryside, men versus women, the high versus the low social economic class etc. etc.? In other words, strictly speaking the demand for continuous 'indigenisation' leads to an infinite fragmentation of psychology, and ultimately to solipsism, where nothing but silence remains. Eventually
the cultural specificity can only be understood against the background of communality and the universality of theories and methods, and not vice versa. Insights that have been acquired through subjective and culturally contextualised methods always have to be verified or falsified with methods independent of the subjectivity of the observer and researcher in order to achieve a scientific character. Science requires objectivity and independence.

**Autonomous or value-bound**

As explained in the introduction, the second issue we want to discuss in this paper refers to the interaction between science and ethical norms. The first and basic question in this connection is whether science is value-free or value-bound. In the tradition of the positivistic/rationalistic demand for autonomy and freedom of science, many scientists have defended the former position. Their argument is that scientific knowledge as such does not have a moral or ethical connotation. Science tells us how the world is, and not how it should be. Science is driven by the curious search for the truth and not primarily by the hope to improve the destiny of humankind. Ethical and moral problems only arise when science is applied and produces usable objects or services. These can be used for better or for worse, but the scientific products as such (insights, ideas, knowledge) are neutral and a-moral.

Of course, the freedom to formulate and adhere to its own laws and criteria is a sine qua non for science. The pressure of powerful institutions or persons or economic and financial interests can seriously corrupt scientific results, as tragic examples have shown throughout history. Without this freedom science will sooner or later become irrelevant and useless. But this is not paramount to saying that ethical values and norms do not have a legitimate place in scientific endeavour (see also Drenth, Fenstad & Schiereck, 1999). Arguments for such an imperative interdependence have been raised - arguments that are not easily refuted. Let us list these arguments and thereafter draw a conclusion from this section:

- All scientists and scholars should reflect on the paradigmatic presumptions and the socio-historical entrenchment of their scientific endeavour. Science is based upon the (non-scientific) assumption that there is order in the universe whose principles can be understood by human ratiocination. Our conceptualisations and models are always abstractions of reality, and we can only achieve approximations - or 'reconstructions' - of this reality. Science
abstracts and reduces reality in order to get a hold on it, but that implies that there are more kinds of knowing than scientific cognition. The 'knowledge' of a loving mother when regarding her child is different from that of a cognitive psychologist, but not less realistic or less discerning. In other words, the nature of scientific knowledge is limited and does not dominate over all human knowing. These reflections and basic assumptions are in themselves not scientific by nature, but metascientific and value-embedded.

- Another metascientific question ensues from the choice of subjects to be researched or, rather, from those to be ignored. Is that which the scientist and scholar pursue, worth knowing? The choice of scientific issues to be addressed has to be justified, not only for the scientist and scholar personally, but more often also publicly, since taxpayers or a sponsor's money is involved. In essence, this justification implies non-scientific and value-bound decisions.

- These days it is generally accepted that in their research and production of knowledge, scientists deal with a social reality that is fundamentally affected by these findings and this knowledge. A variety of social objectives of great value, including health, safety, peace, a sustainable environment, communication, mobility, privacy, and economic development, are radically influenced by modern science. Many ethical or socio-political problems and differences in opinion result directly from scientific research's advances. This insight and the anticipation of the changes that are effected form a necessary, but essentially non-scientific obligation for scientists.

- The argument that value-free autonomy has to be reserved for science and value-bound dependence for applied science and technology, loses its strength in view of the increasingly blurred borderline between basic and applied science. There is a good deal of overlap between the two spheres and it becomes more and more difficult to identify a part of science that does not affect or is not affected by technology. But even if scientists refrain from actually suggesting the ethical choices to be made and restrict themselves to the presentation of the probabilities and risks associated with certain options, this is not value-free. Risks involve normative choices, as is illustrated by modern medical or environmental research, and scientists have to face these choices. There are further value-bound questions such as: risks for whom? How far does the right to know go? What is the proper balance between self-determination and certain groups’ interests vis-à-vis the society as a whole? How certain does a scientist have to be before issuing a warning, especially where irreversible developments (e.g., regarding global change) are concerned?
Finally the research process itself is subject to social and ethical norms. Scientists have to ask themselves what effects the research has on the object being researched, regardless of whether this is a human being, an animal, the natural environment, a social system or a cultural artefact. Informed consent in medical research, protection against the invasion of privacy in psychological research, genuine care for animals in biological research, avoiding the instigation of unrest or the giving of unjustified hope in social research, preservation of historical integrity in archaeological excavations, are all cases in point.

Given the power of these arguments, our conclusion must be that scientific and scholarly research is embedded in the context of values, interests and political motives. Rather than denying this, or retreating to the safety of the ivory tower, scientists and scholars would do well to acknowledge this and take the associated responsibilities seriously.

Ethical constraints

As we have seen in the foregoing section, science cannot be regarded as an absolutely free and autonomous enterprise; it is bound by socio-ethical values and its freedom is restricted and cannot be defended at all costs.

An interesting question is whether such ethical inhibitions have to lead to 'no-go' (wholly unacceptable) or perhaps 'slow-go' decisions with respect to certain areas or subjects of research. 'Slow go', for instance, would apply if research, or the analysis or interpretation of the results should be temporarily suspended until the ethical implications have been subjected to public discussion, and some consensus has, preferably, been reached.

Examples of both types of constraints are easy to find. There is little disagreement on the unacceptability of attempts to make human-ape hybrids, the application of germ line genetic manipulations to enhance musicality or intelligence, or human cloning for procreation. These subjects would fall under the 'no go' regime, at least at present. Furthermore, not all the consequences of modern medical and gen techniques, as far as diagnostics as well as therapy are concerned, have been fully realised, and some of them need thorough reflection and discussion before they can be applied easily and without remorse. A recent report of the Science and Ethics Advisory Committee of the Royal Netherlands' Academy of Sciences has, for example, started such a discussion on the pressing question of prenatal testing
For some of these topics a 'slow go' adage may very well prevail.

At this point it is important to realise that any discussion of constraints to be imposed on research is fraught with danger. History abounds with examples of science being silenced or repressed because its research results were not consonant with the ruling ideologies, or because they did not favour the interests of the political or economic authorities in power, or were opposed to the interests of movements or action groups. Even if such movements have reputable objectives, such as peace and détente, equal rights for women, and protection of the environment, infringement of the right to investigate and bring to light the results of this investigation on the basis of the political unacceptability of certain outcomes to external groups, is highly precarious.

We would further like to assert that it would be a mistake to refrain from doing research into a given subject or problem because it might possibly be misused or applied irresponsibly. That would virtually mean the end of all research since no scientific result is secured against wilful abuse. Moreover, outcomes of fundamental and innovative research are often surprising and hard to predict, and this makes it difficult to constrain research on the grounds of potentially undesirable or dangerous outcomes.

Nevertheless, it is an undeniable fact that in almost all societies scientific research is pegged down by social, political or legal restrictions, which are based on ethical or moral values. With reference to the theme of the present conference, the question arises whether these constraints are universal or culture-specific. It is obvious that many legal, social and ethical confinements are definitely culture-bound. This is why we find such large differences in ethical constrainments between countries. Social and ethical norms are rooted in religion and cultural traditions and are (as a consequence) converted into political or legal regulations. And it should be clear that these vary considerably between countries.

In fact, if only scientific arguments and rational risk analysis prevailed, there would be far less disagreement between countries than found at present. There is no scientific evidence whatsoever that the currently approved genetically modified foods pose a threat to public health or the environment. Moreover, advances in plant genomics research have opened a new era in plant breeding, which is fundamental to European needs to enhance agricultural productivity and sustainability to ensure food security, health, environmental safety, and novel crops, as a recent EASAC report states (EASAC, 2004). Still, many European countries resist GM foods, or
try to scare off consumers by placing ominous warning labels on these products. Research on stem cells is another case in point. The regenerative power of stem cells isolated from embryos cultivated in vitro has opened a whole new perspective on the medical therapy of genetically determined human diseases like diabetes, Parkinson, Alzheimer and various forms of cancer. Nevertheless, national debates on the acceptability of this kind of research have led to quite diverging viewpoints and legislation in the Western world, with the religiously conservative countries like the USA, Ireland and Italy (together with Germany, but that may be caused by the 'Mengele-syndrome', originating from the Second World War) as the strongest opponents, and countries like Great Britain, The Netherlands and the Scandinavian regions as the strongest proponents. A recent special report in *Newsweek* of April 5, 2004 ('The God effect') presents an instructive overview and analysis of people's resistances against the advancements of science on religious, spiritual or cultural grounds. In any case, it is plain that different views, based on religious or traditional values, may lead to quite different positions with respect to the acceptability of certain scientific studies and can lead to varying normative, political and legislative restrictions to scientific research.

But is there also universality in this respect? Are there ethical constraints to scientific research that affect such peremptory values of mankind that they would be incontestable for all scientists and scholars, and therefore would have a universal character? Which ethical constraints would be so fundamental that they could have such a universally imperative character? As in respect of the universality of human rights, it is not easy to formulate such incontestable ethical constraints to science, but maybe we can agree on the following principles (see also Drenth, 1999):

a. Research is not justifiable if, before, during, or after an experiment or the gathering of empirical data, unacceptable damage is inflicted upon the object of the research (whether this concerns people, animals, nature or culture), or upon its wider social or physical environment (unrest, pollution).

b. Research is not justifiable in cases where the nature and/or consequences of the research are in conflict with basic human values that include respect for human dignity, the guaranteeing of autonomy and freedom of choice for all individuals, informed consent prior to participation in research, and the rejection of every intent to commercialise the human body.

c. Research is not justifiable if it contravenes solidarity, firstly with mankind, thus not guaranteeing the treatment of fellow human beings on the basis of equality, secondly with posterity, thus not embodying the broader
responsibility for the sustainable development of the planet that has to be left for future generations.

References

Section III
The Role of Academies of Sciences and Humanities
An Academy of Sciences and Humanities: Where Does it Stand for?

Cyprus, 2004

Introduction

Science is the main driving force behind modern society, and its power is both admired and feared, as D. L. Ray observed when he wrote: "The general public has long been divided into two parts: those who think science can do anything, and those who are afraid it will".

In a more serious vein, a similar recognition of the saliency and indispensability of science can be heard from responsible official sources: 'Relevant science' is one of the corner stones of European Commissioner Busquin's successful plea for a European Research Area. Not so long ago, the UK's Prime Minister Blair acknowledged the importance of science for his country's future in a speech titled 'Science matters' which he delivered at the Royal Society (23 May 2002). And while he was the President of the European Union, the Irish Deputy Prime Minister Harney stated: "In today's economy, neither natural resources, cheap labour, nor capital stock are as important to the national competitive advantage as innovation built on new ideas and new knowledge." "The power of a nation", wrote the Nobel laureate Francois Jacob in Le Monde on 8 April 2003, "was long measured by that of its army." "Today", he continued, "elle s'évalue plutôt à son potentiel scientifique."

These examples suffice to demonstrate that currently science has, or ought to have, a central position in society as an important promoter of society's economic, cultural and social development. There is no doubt whatsoever that humankind owes much of its enormous improvement in welfare, health care and general well-being to science and technology. At the same time, however, there is also criticism and fear of, as well as aggression towards scientific and technological advances (modified food, genetic engineering, cloning of animals, environmental degradation, loss of biodiversity, nuclear waste.....). This has to be acknowledged as well, and more than ever before it forces the present-day scientists to be self-critical of and accountable to the public.

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general public for their work and findings. We will return to this theme in the course of this address.

Given the central importance of science, who or what are the main stakeholders and actors responsible for the furthering and growth of science in a society? Basically, three categories can be distinguished:

(a) Funders and sponsors. The main distinction here is between public and private funding. Public funding is usually governmental funding, which means deploying taxpayers' money. Part of this public money goes directly to universities or institutes as basic, structural financing. In most countries, the distribution and allocation of that part of public funding that is reserved for fundamental research, is delegated to a National Research Council, the autonomy of which can vary from total to modest. Examples of the latter situation occur where governments want to prescribe the priority areas, and/or want to have the final say on the choice of programmes or projects. Private funding can be provided by industry, private institutions, individuals, or agencies in the private sector. Privately funded research is usually problem driven, applied research, whereas publicly funded research is a mixture of applied and fundamental research.

(b) Performers and executors. These are the research workers and institutes that carry out the research in a variety of settings. Researchers can be employed by universities or public research institutes, by national or regional governments, by agencies, by consultancy firms, or by industrial companies. Again, most fundamental research is carried out by researchers working at universities or public research institutes.

(c) Advising and evaluating and science-promoting agencies. There are various types of advisory bodies in the different European countries, including councils for advice on science and technology, on science for policy-making, on social and ethical issues related to science, and (often ad hoc) review or evaluation committees or panels. But in almost all European countries an important role, as far as these evaluative and advisory tasks are concerned, is played by a (mostly single) National Academy of Sciences and/or Humanities.

Such an Academy is basically a learned society, with (a restricted number of) members who are solely selected on the basis of their scientific or scholarly qualifications and reputation. Most of the members usually live within the country, but they can also work in other countries around the world. Most Academies also have foreign members, i.e. foreign scholars or scientists with an outstanding reputation who have (had) an important relationship with the relevant country's scientific or scholarly community. An
The general mission of an Academy

It should first of all be said that to date the world of Academies of Sciences and Humanities is far from homogeneous. There is quite some variety in scope, mode of operation and impact among European Academies. Nevertheless, one important characteristic set of objectives has united Academies throughout history and in their present geographical diffusion: the attempt to further the critical scientific thinking in a society, the desire to advance top level scientific and scholarly research, and the promotion of science's independence and freedom as a *sine qua non* for its advancement.

These two conditions, freedom and independence, have always been the essential characteristics of an Academy. In fact, this was the very reason for the creation of the first *Akademeia* in Athens some 400 years before Christ, and for the revival of the idea almost two millennia later during the Renaissance in Europe. The very value of an Academy springs from its independent and uncontaminated search for truth, an asset that Emperor Justinian did not appreciate when he closed Plato's Akademeia some thousand years later, because the views developed in the Academy were not in line with his own. In the 16th and 17th century, universities were increasingly placed under the yoke of church and state, which lead to a growing need to find a place where scientific problems could be discussed freely and safely. This opportunity was created in the newly founded Academies of those times: first in Italy, later in other European countries as well. *Accademia dei Lincei* in Rome was founded in 1603, *Académie Francaise* in Paris in 1635, *Leopoldina* in Schweinfurt in 1652, the *Royal
Society in London in 1662, the Académie des Sciences in Paris in 1666, and the Brandenburger Sozietät der Wissenschaften in Berlin in 1700. In these revived Academies, the spirit of independence and intellectual freedom made them free havens for oppressed and persecuted scientists to freely express their views and to pursue their research ideas. In their fertile soil, the development of novel and often revolutionary scientific ideas and theories became possible.

As said, in spite of this conspicuous common goal, the present Academies show a great variety in roles, tasks and modes of operation in their attempt to achieve it. In the following we will focus on an Academy's three main objectives and tasks as they have developed throughout history.

Promotion of science and scholarship through communication

First of all, most Academies have an extensive meeting and communication function. Generally this is regarded as an important devoir of an Academy: the exchange of views and scientific information between members, between members and non-members, between Academies and sister institutes within and outside their country. In an active Academy gathering of the general assembly, divisions or partitions occur on a regular basis. Special meetings, theme conferences, colloquia and workshops are organized by Academies, or take place under their auspices. International contacts, reciprocal visits by scholars, the exchange of periodicals and other publications further stress the meeting function's international character.

With respect to the communication function, we deal with an Academy's central and salient role: the presentation and discussion of new discoveries, new insights, new interpretations, and the promotion of intellectual debate through a critical confrontation with colleagues have not infrequently lead to a deepening of insights, or even the shifting of frontiers. This is what Plato had in mind and what inspired the founders of those new Academies in the Renaissance.

It goes without saying that these scientific debates are only efficacious if all top scientists and scholars in a country participate. This leads to three important conclusions with respect to Academy members' selection:

(1) For Academy membership only scientific and scholarly criteria should apply. No political, ideological, or social considerations should be allowed to play a role. Administrative qualities and management experience may be supportive, but can never replace the scientific yardstick.
A second requirement is that enough younger, creative and innovative researchers should be included. At present the danger of 'conservatism' is reinforced in many Academies due to restrictions on the number of members and the high age at which members receive a 'resting' or emeritus status, which in many Academies is 70 years or higher, or sometimes even non-existent. In my opinion, a lower age-limit for emeritus membership (say 65 years) is the best way of allowing more younger scientists, who do not belong to the 'old boys network', to be admitted to an Academy.

Given the restricted number of places in an Academy, it is inevitable that not all high-level scientists and scholars can become members. It is, nonetheless, still important for an Academy to be able to activate the wider range of expertise in its own country and abroad. Some Academies solve this problem by creating a category 'aspirant' or 'corresponding' member. Others invite 'outsiders' to become members of advisory committees or working groups. Anyway, it is crucial for an Academy not to isolate itself from the scientific community at large.

A final word in this respect about another Academy asset: thanks to the availability of expertise from a variety of disciplines, there is ample potential for a multi-disciplinary debate. In past times, because of science and philosophy's general character, such discussions were a matter of course. With the present increasing differentiation and specialization, the multi-disciplinary address is becoming more and more uncommon. Still, an Academy is the place par excellence to give this traditional and important aspect of scientific communication an abiding place on its agenda.

**Promotion of research**

In the beginning, the primary task of the newly created Academies was research. The university of that time (universitas magistrorum et scholarium) was basically a learning institute, intended for the transfer of the attainable, canonized knowledge. In addition, these universities - certainly in the 16th and 17th centuries - had strong ties with the churches' ideologies. Academies were the places for research, and, hence, more independent of church doctrines. They therefore performed a function, which the universities could not accomplish.

Only in the 19th century did the Academies start to lose this primary research task, a tendency which continued in the 20th century, at least in the non-socialist countries. This had a number of causes: In the first place,
specific research institutes were created outside the Academies, sometimes supported with public, sometimes with private funding. Secondly, research increasingly took place within universities; indeed, in many cases carried out by Academy members who had accepted professorships at these institutes of learning. In the third place, other institutions were created for the supervision and financing of research programmes, the predecessors of the later Research Councils or Research Organizations (e.g. Max Planck-Gesellschaft). Finally, the nature of research changed. It increasingly developed - and this is particularly the case in the experimental and empirical sciences - into a collective activity carried out by research groups instead of individual scientists. It became more and more difficult for Academies to offer the appropriate infrastructure and funding.

Simultaneously, the nature of Academies changed. They became societies of scholars whose members pursued a variety of professions outside the Academy: at universities, in libraries and research institutes. However, also in this period Academies’ influence on research should not be underestimated, due to the enduring scientific discussions and debates, and because of the actual support of publications, scholar exchanges, and even expeditions (such as those of Darwin and Livingstone, sponsored by the Royal Society of London, or the Kamtschatka expedition under the auspices of the Russian Academy in St. Petersburg).

In the 20th century, the Academies in Central and Eastern Europe took a different direction. In those countries the Academies often accommodated very large numbers of research institutes. In fact, the bulk and the best of fundamental and applied research were allotted to the Academy institutes with the objective to advance socialism and the countries’ scientific-technological progress (Grau, 1988, pp. 315).

The second half of the 20th century and the early years of the 21st century present a varying picture with respect to Academy research. Top-level frontier research is carried out (among others) by academicians, but mainly at their own universities or research institutes. As far as their role in research is concerned, most Academies confine themselves to the stimulation, sponsoring, or (in certain cases) execution of specific projects. In many cases, these high-quality projects are of long-term duration and a multidisciplinary character. Other Academies (such as the Royal Netherlands' Academy) have research institutes under their jurisdiction in which important high-quality research is carried out that has not found a place within universities because of its scope, its inter-university character, or for other strategic reasons.
There is no ready answer to the question: "What is the ideal formula?" The answer depends on historical and national conditions. In general, we would wish Academies to take a reserved attitude towards taking actual responsibility for the execution of research, but there may be circumstances under which Academies have to play a more active role. We could perhaps agree on the following principles:

- Research and education are mutually dependent on each other, and should not be separated. In principle, research, also fundamental research, should take place at a university.
- If there are additional organizations for the promotion of basic or applied research, Academies should not interfere in their activities.
- If major blank spots were to remain on the national research map, or if certain important projects could not be carried out by universities or other institutes because of their scope, their interdisciplinary character, their expected duration, or for other reasons, and if there is agreement that an Academy should bridge the gap, it should be entitled to do so.

Advisory function

Although the advisory function was not always explicated in academy bylaws, many Academies have considered it their responsibility to convey judgements based on their scientific insights to governments, institutions or the public at large. In previous times, monarchs too acknowledged the usefulness of science for the promotion of trade and commerce, and prestigious Academies like the Royal Society of London and the Académie des Sciences carried out a good deal of applied research. Leibniz was very disturbed by the fact that Leopoldina restricted itself to pure and fundamental research, and the Brandenburger Sozietät, which he founded in 1700, explicitly included the application of science for the benefit of the state in its objectives.

Later the Academies were confronted with an advisory role, often in an informal way, but sometimes also explicitly prescribed by law or regulations. For an Academy this is possibly the most challenging, but at the same time most controversial role. What types of advices can be distinguished? We would like to single out four categories of advices:

1. Advices based upon quality assessments. One could consider advices with respect to the continuation, termination, or adaptation of certain lines of research, programmes or projects, or to the appraisal of individuals or
research groups for the endowment of scholarships or prizes. Academies can also play an important role with regard to the growing practice of calling in visiting committees’ assistance with the evaluation of departments, faculties, or whole institutes. Furthermore, policy-making bodies are increasingly making use of research foresight advices, which are concerned with trends and developments in various scientific disciplines; such foresight advices could be offered by Academies.

(2) Advices regarding science policy. Examples are advices on the desired balance between pure and applied science, between natural sciences and humanities, and between scientific research and science education. Also advices regarding the content of certain institutionalised forms of organising, or financing scientific research, or advices on the curricula of graduate research schools and on career opportunities of young scientists are applicable here. This category further includes advices on the prioritising of research areas for funding within the realm of the chosen or desired national strategic research policy.

(3) Advices on political issues and decisions. In this regard scientific research could offer an important, sometimes even indispensable, input. Some of these advices have a medium- or long-term perspective (global change, energy, system of medical care, infectious diseases, peace and détente, world population). Others have a more immediate or acute character (BSE, mouth and foot disease, radiation through mobile phones, earthquakes). For some of these advices abundant and solid knowledge is available and only needs 'translation'. For others only incomplete, probabilistic and uncertain knowledge is available, which requires a different type of advice (more constrained, or more in terms of the expected risks and probabilities), or even to the suggestion to refrain from any advisory activity, due to the inadequacy and insufficiency of the scientific knowledge.

(4) Advices on ethical and societal questions related to or generated by scientific research. Some of these questions have an internal character. They have to do with scientists' (im)proper behaviour (fraud, deception, plagiarism), or with problematic forms of experimentation or data gathering (informed consent, privacy, intellectual property), or with problems with the media (too optimistic or unjustified reports, misquoting). Other ethical problems have an external nature. They relate, for instance, to the question of what is being done with the results and by whom (contract research, commercialisation of research results, misuse or misinterpretation of results), or to issues generated by the research itself, such as research on stem cells
and embryos, xenotransplantation and cloning, information and privacy, nuclear research, and others.

As far as the advisory role is concerned, and in particular with regard to the ethical and societal questions, we touch upon an interesting and important issue, namely the supposed primacy of scientific objectives for an Academy. Is not veracity the main touchstone of its activities, and should it not refrain from ethics and normative questions?

From the correct presupposition that Academies should be primarily concerned with scientific truth, it would, in our view, be a major mistake to derive that scientists, and Academies of science for that matter, do not bear a moral and societal responsibility. True, scientific practice is inconceivable without the freedom to think, to speak, to carry out and to communicate about research. If science is unable to retain its independent and impartial nature, it will sooner or later become irrelevant and useless. But at the same time there is the - in recent years increasing - need for public accountability. Scientists are nowadays confronted with a variety of ethical, social and political questions which cannot be trivialised or pushed aside with the argument that they are normative and not scientific. The future challenge for scientists and Academies of science is therefore not to make a choice, but to find a balance between freedom and responsibility.

Then a more basic question with respect to the advisory function in general: Are Academies equipped for such an advisory role? The following elements make out a good case for an affirmative answer. Firstly, there is abundant scientific knowledge and experience within their walls. Secondly, Academy members are (should be) 'disinterested' in the proper sense of the word: in an ideal situation they are not guided by any political, economic, regional or professional interest, or turn into another political pressure group. Thirdly, these members have a firm scientific orientation, and emphasize science's free and uncontaminated nature. It is primarily scientific truth and its pursuance that guide their deliberations.

However, whether Academies will also become a major advisor in ethical, social, and legal matters, as described above in points 3 and 4, depends on the willingness of the Academies (and their members) to take science's moral and societal accountability seriously, and on the public's willingness to assent to the Academy taking such a role. It further goes without saying that an Academy in its advisory role should collaborate compliantly with other agents in the field, each acting from its own position and with its own perspective: universities (educational policy), national Science Research Councils (funding perspective), other national science or technology
advisory committees (with a disciplinary or technological perspective) etcetera.

**Internationalisation**

Finally, a word about internationalisation - rather to be expected from a speaker who represents an international federation of national academies. Present-day science cannot grow in isolation. It presupposes cooperation and contact, exchange of knowledge, expertise and research results. And, of course, these contacts have to cross national borders. There is no longer such a thing as 'national science'.

The international nature of science and scholarship has always been apparent, as was symbolized by the many 'international' scholars in the 15th and 16th century (Erasmus, Keppler, Huygens and Descartes a.o.) who travelled widely and published for an international public (in Latin, of course), and by the frequent exchange of scholars and scientists between the various European Academies in later centuries. But currently science's global perspective has become particularly conspicuous with the explosive developments of fast and easy means of electronic communication. Moreover, many current research themes have an international character and cannot be studied from a purely national perspective (environment, health and infectious diseases, transport, trade, migration, tourism). National funding alone falls short of what is needed for a number of mega-programmes and only combined efforts can furnish the necessary means (CERN, EMBL, ESO). Collaboration and collective efforts can also strengthen the competitiveness of the higher level (e.g. the European) gremium, which is a basic argument for the European Commission to promote the 'European Research Area' with its complementary character and added value vis-à-vis the national research programmes.

Academies are full and active partners in this international scientific collaboration. In respect of Academies' position, the whole is also more than the sum of the parts. Hence, a European association, such as the All European Academies (the European federation of national Academies of Sciences and Humanities) intends to be more than the sum of national Academies in Europe.

The idea is, of course, not new. Already in 1787 Johann Gottfried Herder advocated a united German Academy that transcended the local Academies of those times. Later, the German Academies united their research efforts in
a Kartell, since the requirements of an important research programme (*Enzyklopädie der mathematischen Wissenschaften*, and *Thesaurus linguae latinae*) exceeded the available resources of any single Academy. In 1899, many European Academies united in the first 'International Association of Academies': the German Academies of Berlin, Göttingen, Leipzig and München, as well as the Academies of London, Paris (Académie des Sciences), St. Petersburg, Rome and Vienna. One non-European Academy joined, the American NAS. One year later the Academies of Amsterdam, Brussels, Budapest, Oslo, Copenhagen, Madrid, Stockholm and Paris (the two other Academies within the 'Institut') joined. From this agglomerate and through a politically complicated roundabout way, the two most significant international scientific organizations emerged: the 'Union Académique Internationale' (UAI) for the humanities, and the 'International Council of Science' (ICSU) for the natural sciences.

New opportunities for co-operation arose in Europe in the 1990s, due to the end of the Cold War and the increasing significance of the European Union in the area of science and higher education. Initiated by the Académie des Sciences, the Royal Society, the Royal Swedish Academy and the Royal Netherlands' Academy, ALLEA was officially constituted in 1994. ALLEA's members are the national Academies of sciences and humanities. It now has members from all over Europe, from Iceland to the Urals, from within the European Union and beyond. ALLEA exchanges information and experience among Academies. In ALLEA, the national Academies collaborate to serve the scientific community, European political organizations and the general public. Committees and working groups focus on science and ethics, intellectual property rights, privacy in the information society, research strategies in smaller countries, science and the media and other issues related to science and scholarship in Europe.

**Conclusion**

In the foregoing we have presented an overview of Academies of Sciences and Humanities' major roles and responsibilities throughout history and as they are still found to-day. As was said in the introduction, at present there is quite some variety regarding the ways academies have shaped these roles and responsibilities in the light of the particular historical, legal and political context in which they operate. A first and most crucial consideration for any country that is not as yet fortunate enough to have an Academy and is
considering creating one, is to acknowledge this socio-political context and let this context tailor the model. Secondly, it is important to analyse to what extent the various duties of an Academy, which have been explained in this paper, ought to be performed in the country, or, if an existing body already discharges them, whether they could be better performed by an Academy. In other words, an Academy should have a demonstrable added value, and should not be called into being for reasons of prestige or alleged obligation. I hope it has also been made clear that once an Academy has been founded and is in operation, it can be a significant enrichment of the auxiliary forces in any nation that supports the growth of its science and scholarship.

At the same time - and we will end this address with this mitigating annotation - science is not the sole determinant of progress and development. As Christophorou (2001, p. 278) observed "A strong science will be a necessary, but not a sufficient condition for a better society". Proper ethical principles and values to guide the implementation of scientific findings and moral responsibility in the application of research are indispensable conditions for real progress in the civilization and humanization of the world. In fact, this consideration goes beyond the Aristotelian line of thought in which *epistême* (scientific knowledge) is more highly appreciated than *phronesis* (the practical wisdom). It is more in line with the mental legacy of Zeno of Kytion for whom knowledge as a product of the perception of the senses was valuable, but for whom the highest asset was virtue in harmony with nature. Perfection is realised not through enjoyment, but through virtuous wisdom. In that sense we should all become true *stoikoi*.

Finally, the adjective *kuprogeneia*, meaning 'created on Cyprus', has acquired a very positive connotation, since this was an epithet for Aphrodite, the goddess of spring, pulchritude and fertility. Let us hope that whatever form will be chosen for a possible academy, this reference to beauty and fruitfulness will prove appropriate. And let me then end with a plea for a safe journey for this Akademeia, as was usually expressed in the classical prayer to Aphrodite: *Euploia*!

**References**


Introduction

The first Academy of Sciences was created by Plato in the 4th century before Christ. The location was actually a grove outside Athens where the hero Akademos was honoured, and where sport and exercise were practiced as an essential part of young men's education. When Plato chose that piece of ground he was not primarily interested in continuing physical training of this kind, but in providing a school for the practice of philosophy, which he considered essential for a properly functioning political and governmental system.

There is more symbolism in this onset of Academia: The grove from which academies take their name was situated just outside Athens, outside the centre of public life. A walk in that area afforded excellent scope for philosophical reflection, inspired not by a wish for isolation, but by the desire for independent research and reflection. Both now and at that time, this independence is and was a matter of immense significance, not only concerning scientific analyses and evaluations, but also concerning the Academy's advisory activities in particular. The emperor Justinian did not realise that he was curtailing a vital source of political life when he closed Plato's Akademeia a millennium after its founding, because its views were not in line with his own, and therefore considered injurious to his ruling.

In the following, I hope to demonstrate that this independence and autonomous position of an Academy are of crucial importance in respect of its contribution to the advancement of science as well as to the welfare of society and humankind.

Science and policy-making: two different worlds

The clear distinctiveness of science and policy-making should not be questioned. In the former, the principal norm is verity and the motivating
force, the search for the truth. Policymakers are led by political calculations, utility, moral attitudes and value preferences. They may listen to scientists and may use their findings, but the ultimate criterion is political feasibility and attainability and not veracity.

I do like to emphasize that the distinction is not to be regarded as that between certainty (of knowing) and uncertainty. It would be a misunderstanding if scientific input were to be mistaken for certitude and definite knowledge. There is, of course, solid and experimentally validated knowledge. But more often the scientist's knowledge is less solid, uncertain and incomplete. And in particular with respect to many sensitive and pressing questions in society, this knowledge is certainly of a probabilistic or contingent nature, due to either ontic (really existing in the outer world) or epistemic (insufficiently measured or known) uncertainties. Needless to say, feckless claims and unjustified solidness with respect to this probabilistic and uncertain knowledge are harmful indeed.

It is important to keep this distinction in orientation between scientists and policy-makers in mind when the advisory role of science is at stake, and in particular when scientists are asked to give their opinion on sensitive and weighty political issues. They can offer proper and careful analyses of the problems at hand, they can point to the (high or very low) probabilities regarding certain outcomes and risks involved, they can denounce stereotypes and prejudices, they can show that certain anxieties have no statistical justification, or that great optimism is not warranted given the available evidence, but they should not take over the responsibility from the actual decision makers. It is not up to the physicist to establish whether or not nuclear energy should be exploited. It is not up to the ecological biologist to decide on the maximally permissible level of automobile exhaust gases. It is not up to the psychologist to decide whether deeply depressed, incurable patients should be allowed euthanasian termination of life. Then we would require too much responsibility from scientists. As Wolpert (1989) once said, it would give power to a group that is neither trained nor competent to exert it.

**Breaking the rules**

The distinction, as defined above, should be acknowledged by both parties - the scientist and the policy-maker that seeks advice from the scientist. Confusion of the two spheres leads to disordered argumentation, to a false impression of things and to obscure decision-making.
Sometimes it is the policy- and decision-maker who breaks the rules separating these two spheres. He starts arguing against scientific facts, or about scientific interpretations. Sometimes he engages other scientists who are willing to argue against unwelcome research findings. Examples are medical researchers' subversive activities in the service of the tobacco industry *vis-à-vis* the research on passive smoking's effects, or the Bush Administration's scientific advisors attacking the Kyoto Treaty's scientific assumptions.

But for our purpose it is more interesting to have a look at those scientists who seem to be breaking these rules. Does it occur, and if so, in what form? We can distinguish three types of 'trespassing' that differ in the extent to which they violate science's independence criterion.

1. A first category is constituted by researchers' tendency to focus too emphatically on the policy and practical implementations of their research. The operative word here is the adverb "too". I am not suggesting that scientists should refrain from contemplating the useful application of their findings. On the contrary, I have time and again repeated that scientists' responsibility for what happens with their results goes beyond their laboratory doors. But the line between scientifically substantiated conclusions for policy and personal preferences and opinions is thin. Mixing the two makes the debate on scientific input's added value confusing.

2. A second danger is caused by scientists who give their opinion on political and social issues without speaking as (applying) scientists. They give their opinion (often in the popular media) on issues for which no empirical evidence is available, or at their disposal (for instance, because it is not their field of expertise). Nevertheless, when speaking as scientists, this creates an illusion that such evidence is available. The words of esteemed scientists (Nobel laureates are often abused for this purpose) will have a particularly strong impact. Of course, scientists have a right to express their opinion on political and social issues like every other citizen, but the misapprehension that their opinion is more valid than that of other citizens should be dispelled.

3. A third, and the most serious, violation of science's independence is the attempt to reach conclusions that are welcomed by and favourable to the policy- or decision-maker. This can take the form of straightforward fraud, including the fabrication, falsification, or trimming and selective use of data. It can also take the form of what can be called deceit, an attempt to lead the reader up the garden path by, for instance, deliberately violating the rules of
data analysis and processing, by gross negligence in sampling, or by incorrectly suggesting that conclusions are based upon empirical data (see also Drenth, 1999).

As indicated, the most serious violation of science's independence is caused by the third category in which science's integrity is gravely endangered. Of course, this can be rooted in personal factors, such as dysfunctional ambition, vanity, desire for recognition, or personal gain. But in line with our argument, we would rather focus on the external pressures brought to bear by influential policy-makers that give rise to such infringements of independence.

Causal factors

The following two categories of external influences can be distinguished:
(a) The first is the pressure from powerful institutions or persons who oppose an honest analysis and reporting of the research. And this is not just a reference to history with such well-known examples as Galileo, More or Lysenko. Also today, and perhaps notably so, there are examples of the political intimidation of scientists. Hard data are difficult to find regarding how widespread this phenomenon is, particularly since the pressure can be rather subtle and unobtrusive, and since the 'victims' are not always prepared to bring it to light. But sometimes the latter do make their grievances public, and cases in point are published either in the scientific or in the popular media.

A few years ago, the New England Journal of Medicine described how the pharmaceutical industry lobby applied undue pressure on researchers who intended to publish data that it found unwelcome (Deyo et al, 1997). Recently we could read about the complaints of the American Union of Concerned Scientists (UCS) regarding the manipulation of the process through which science enters political decisions (The Economist, 10 April 2004). Although President Bush's science advisor John Marburger has tried to rebut these claims (Nature, 428, 8 April 2004; Science, 305, 30 July 2004), many of them still prevail, one of the notorious cases being the eminent cell biologist Elizabeth Blackburn's (University of California, San Francisco) dismissal from her position on the President's Council on Bioethics, because, she claims, of her outspoken support for research on human embryonic stem cells. I am sure all countries have their own and well know cases. In my own country, for instance, we recently had the experience
of the geophysicist Berkhout, the chairman of a scientific committee that was to advise the Minister of Transport on Schiphol Airport's new noise criteria. Berkhout declared that after having been put under pressure, after having been quoted incorrectly, and after having to endure personal attacks in the media, he had decided to resign from the committee (NRC-Handelsblad, 2 December 2003). A few years earlier Köbben and Tromp (1999) had published a number of such cases in their book titled 'The unwelcome message'.

Sometimes the pressure on researchers is not aimed at distortion of research results towards certain desired outcomes, but at the decision not to deal with certain subjects in the first place, so as not to run the risk of attaining certain unwelcome insights. Again, each country has its own striking examples. A ban imposed by a 'politically correct' university council in the 70s to prevent a criminologist (Buikhuizen) from doing research on criminal behaviour's possible biological determinants, and the societal pressure on brain researchers to stop further research into the differences in the hypothalamus between homosexual male subjects and a non-homosexual control group (Swaab & Hofman, 1990), are cases in point in my own country. The issue has become of topical interest at present, since the threat of terrorism and national security have an effect on the freedom of universities in various countries. In the US, university officials fear that regulations controlling research, and particularly the involvement of and communication with foreign scientists and students will be further curtailed (Science, 304, 23 April 2004).

A special case is the restriction on research results' publication. In principle all research carried out by publicly funded institutions (universities, research institutes) ought to be made accessible to the wider public. A clear and acceptable exception could be national security or defence interests. It is clear, however, that the extent to which these criteria are interpreted may lead to strong differences of opinion between governments and scientists, of which the present ongoing debate in the US is a good example.

Sometimes the sponsor of the research expresses a requirement or desire to keep the research results secret, at least until a possible patent application can be submitted. Since this is a special aspect of a larger problematic concerning contract research, which will be dealt with later, we will not discuss this here in greater detail.

(b) In the second place there are economic and financial motives and interests. Economic interest in research into, for instance, new medicine and pharmacology, into nano-technological developments, and into other
innovative or patent-directed research can be substantial and can exert unwarranted pressure. Here, too, recent history offers a series of striking examples, varying from the thalidomide tragedy to the Chernobyl disaster and the exploded NASA explorer. Sometimes the influences are subtle and wholly unknown. The *Times Higher* of 27 April 2001 revealed that at least 19 review articles published by the highly esteemed *New England Journal of Medicine* had been written by researchers who had secret financial links to the pharmaceutical companies that had brought the examined medicines on the market. In a recent book on the perils of commercialisation, the former President of Harvard University Derek Bok (2003) expressed his belief that the intrusion of the marketplace into the university is eroding fundamental academic values.

At this point it is appropriate to formulate a word of warning in respect of contract research at universities and research institutes that are subsidised by the government. Until a few decades ago, these institutions could almost always rely on public funding for most of their activities. Nowadays, however, they increasingly have to look for assistance from private, external funds. In principle this need not be wrong. It is quite possible for contract research to be independent and unbiased, and to be executed strictly according to the scientific rules of the game. Contract research, therefore, does not necessarily imply an encroachment on research's freedom and autonomy, but the latter can be in jeopardy if a growing proportion of a department, or institute's structural financing has to be obtained externally. After all, results that can be used to the sponsor's benefit are more likely to lead to follow-up research and new contracts than results that are disappointing. Obviously, the overriding temptation is to avoid biting the hand that feeds you.

Maybe a distinction between two different kinds of contract-research is helpful in this respect. The first has the finding of new knowledge as an objective. Of course, the sponsor does hope that this will lead to useful applications, technological innovations, or patents. But the basic objective is augmentation of knowledge. This type of contract research suits the objectives and conditions of academic research at universities or research institutes well. The only debatable point is the wish to keep the research outcomes secret so as to submit an eventual patent application. There is room for negotiation here. The basic objective of university research should be to contribute to public knowledge, therefore the research results should eventually be published, but some delay in publication can be permitted to allow for such a patent application.
Secondly, there is contract research that is prompted to legitimise a political preference or decision. In such cases, sponsors are not so much interested in the objective truth, but rather in arguments that support their view, attract votes, or can be used to oppose difficult opponents, or to answer tricky questions from stockholders. In principle there is nothing wrong with scientists who offer their service to industry, political parties, or a country's administrators, and some of this will sometimes be one-sided or biased, although such services can also be defended as mostly being the best, rendered by honest and unbiased research. Anyway, the kind of legitimising research just described certainly does not belong at universities or research institutes where the search for 'the whole truth' should prevail.

Conclusion

In this presentation we have advocated autonomy and independence of science and scholarship as important conditions for a real and valuable contribution to policy making. We have also seen that there are major threats and dangers to this independence in modern times. Resistance against such encroachments will remain an important challenge for scientists and their Academies.

References


Die Rolle einer Akademie der Wissenschaften:
Veränderung und Kontinuität

München, 2001 *

Herr Präsident, Herr Minister, meine Damen und Herren,


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Ich nenne diese historischen Fakten mit einigem Nachdruck, weil sie mir im Verlauf dieses Vortrags vielleicht behilflich sein können bei einem Plädoyer für die Erneuerung eines wohlverdienten substantiellen Beitrags der deutschen Akademien zum internationalen wissenschaftlichen Austausch.

**Unabhängigkeit**

Diese Rede trägt den Titel 'Die Rolle einer Akademie der Wissenschaften: Veränderung und Kontinuität'. Wir werden bei der Behandlung der verschieden denen Funktionen einer Akademie sehen, dass einerseits in ihrer Zielsetzung tatsächlich von einem hohen Maß an Kontinuität gesprochen werden kann, aber dass andererseits die heutige Zeit im Hinblick auf die Konkretisierung dieser Zielsetzungen und die Art und Weise der Ausführung ihre eigenen Forderungen erhebt.

Ein wesentliches Kennzeichen jedoch ist über Jahrhunderte hinweg unverändert geblieben: ihr selbständiger, unabhängiger Charakter. Als Plato 388 vor Christus seine Schüler um sich sammelte und sie im Hain des Akademos, ausserhalb der umtriebigen Stadt Athen, zu unterrichten anfing, war das nicht nur ein Ort der Ruhe und der Distanz, sondern auch ein Ort, der Unabhängigkeit und Autonomie symbolisierte. Und als Kaiser Justinia-
Rollen und Funktionen einer Akademie


Auspizien, organisiert werden. Auch die internationalen Kontakte, der Austausch periodisch erscheinender oder anderer Veröffentlichungen und gegenseitige Besuche von Wissenschaftlern unterstreichen diese Funktion der Kommunikation.


In den Akademien jener Zeit wurden geologische und physisch-geographische (Apianus, Stensen) Studien betrieben, mathematische (Descartes, Wilkins), naturwissenschaftliche (Newton, Huygens, Oldenburg, Tsirnhaus) und später chemische (Boyle, Guericke) Versuche angestellt, biologische und zoologische (Linnaeus, Van Leeuwenhoek, Swammerdam), astronomische und astrofysische (Keppler, Galilei; Cassini)1) Wahrnehmungen durchgeführt, medizinische Forschungen angestellt (Harvey, Bausch, Mentzel), und sogar das Interesse für praktische und technische Anwendungen der wissenschaftlichen Erkenntnisse (Bacon, Leibniz) geweckt. Auch wurden ausgedehnte literarische und sprachliche (Corneille, Racine, Schickardt, Pellison), historische und pädagogische (Comenius, Skytte, Ratke) Forschungen unternommen. All diese Forschungen schlossen auch philosophische Untersuchungen ein; man kann sogar sagen, dass eigentlich alle damaligen Naturwissenschaftler und Mathematiker zugleich Philosophen waren.

1 Das Greenwich Observatory wurde 1710 der Royal Society unterstellt.


Die Akademien in Mittel- und Osteuropa führen im zwanzigsten Jahrhundert einen anderen Kurs. Dort wurden sie die höchsten wissenschaft-

In Westeuropa bietet sich in der zweiten Hälfte des zwanzigsten Jahrhunderts hinsichtlich der Akademie-Forschung ein wechselhaftes Bild. Hochwertige bahnbrechende Forschung wird (mit) von Akademiemitgliedern ausgeführt, aber das geschieht vor allem an der Universität oder dem Forschungsinstitut, dem sie angehören. Was ihre eigene Forschung betrifft, beschränken viele Akademien sich darauf, spezifische Forschungsvorhaben zu stimulieren, eventuell zu sponsern oder, nach Erhalt von Subventionen, selbst auszuführen. Es handelt sich dann zumeist um Projekte, die eine lange Laufzeit haben, bei denen der Bedarf an hochwertiger wissenschaftlicher Expertise besonders groß ist, und die (in manchen Fällen) einen multi-disziplinären Charakter haben. Andere Akademien (wie zum Beispiel die Königlich Niederländische Akademie der Wissenschaften) beherbergen selbst Forschungsinstitute, wo hochwertige Forschung betrieben wird, die aus irgendeinem Grund keinen Platz an einer Universität gefunden hat oder die von solchem Umfang oder von derartiger Bedeutung für das Land ist, dass es schwierig ist, sie bei einer Universität unterzubringen.

Akademie sich nicht einzulassen. Wenn aber die nationale Forschungs-Landkarte dann noch leere Stellen aufweist oder wenn es sich um sehr langdauernde, oft aus internationalen (zum Beispiel UAI- oder IAP-) Verpflichtungen resultierende Programme oder um großangelegte inter-universitäre oder interdisziplinäre Projekte handelt, für die eine Akademie der Wissenschaften dann doch das geeignetste Dach darstellt, dann kann die Initiative einer Akademie, ein solches Projekt in ihre Obhut zu nehmen, durchaus verteidigt werden.


Erst in viel neuerer Zeit sehen sich Akademien mit einer ausgesprochenen Berateraufgabe konfrontiert, manchmal informell ihr zuge-schrieben aufgrund historischer Entwicklungen, manchmal ausdrücklich in Gesetzen oder Satzungen festgelegt. Um was für eine Art der Beratung handelt es sich? Wir können drei Typen unterscheiden:


(b) Gutachten hinsichtlich der Forschungspolitik, im englischen Sprachgebiet 'science policy' genannt. Gutachten über das erwünschte Verhältnis zwischen Grundlagenforschung und angewandter Forschung, oder das zwischen Forschung auf dem Gebiet der Naturwissenschaften und dem der
Geistes- und Sozialwissenschaften, Gutachtung über die Verteilung finanzieller Mittel, Gutachten über das Verhältnis zwischen Forschung und Lehre, über die Formgebung von Graduiertenkollegs, über Aufstiegsmöglichkeiten junger Wissenschaftler, usw.

(c) Gutachten über ethische und gesellschaftliche Fragen im Zusammenhang mit wissenschaftlicher Forschung. Zu denken ist dabei sowohl an aktuelle und schnell erfordernende Themen, die in der Politik und den Medien eine Rolle spielen (GSE, genetisch modifizierte Lebensmittel, Klonen, CO$_2$-Ausstoß, Verwendung von abgereichertem Uranium in Waffen) als an Themen von mehr grundsätzlicherem, bleibendem Charakter, zu deren Beantwortung eine prinzipiellere und ausgeglichenere Haltung gehört und die ausgiebiger Untersuchung und Diskussion erfordert (Probleme rund Biotechnologie und Humangenom, Umweltschutz und Klimaveränderung, Schutz geistigen Eigentums, Schutz der Privatsphäre in der Informationsgesellschaft, usw.).

Wie ich bereits früher in einem Vortrag vor der Nordrhein-Westfälischen Akademie der Wissenschaften (Drenth, 1995) erläutert habe, eignet sich die Akademie aufgrund ihrer Zusammensetzung ganz besonders als Beratungsgremium auf wissenschaftlichem Gebiet. Die Akademie kennzeichnet sich an erster Stelle durch ein reiches Angebot an wissenschaftlicher Expertise unter ihren Mitgliedern, sodann durch die Abwesenheit von Voreingenommenheit und des Auftrags zur Interessen-vertretung (oder zumindest des Strebens danach), und schließlich durch die rein wissenschaftliche Orientierung und eine hohe Qualitätsnorm. In den Niederlanden wird dementsprechend im Hochschulgezets (WHW) als eine der Aufgaben der Akademie umschrieben: "berät den Minister auf Anfrage oder eigener Bewegung auf dem Gebiet der Ausübung der Wissenschaft".

Internationalisierung


Lassen wir in diesem Zusammenhang den Blick in erster Instanz auf Europa richten, das Gebiet, auf das sich meine Organisation, ALLEA, erstreckt.


Nun erscheinen auf europäischer Ebene diverse Handlungsträger, bei denen sowohl die Qualitäten wie auch die Bereitschaft vorhanden sind, die Wissenschafts- und Forschungspolitik mit zu gestalten. Es besteht darin eine deutliche Parallele zu vergleichbaren Akten auf der nationalen Ebene. Im Hinblick auf die Finanzierung von Forschungsvorhaben gibt es die ESF (European Science Foundation), die meiner Meinung nach einen viel größeren Umfang haben sollte und die einen Teil der heutigen Finanzierungsaufgaben verschiedener Generaldirektorate der Europäischen Kommission (namentlich das GD XII) übernehmen könnte. Die Auffassungen und der Beitrag von EUROHORCS (European Organization of Heads of
Research Councils) könnten über ESF kanalisiert werden. Auf der Ebene der Ausführung der Forschungsvorhaben gibt es natürlich die erwähnten großen europäischen Forschungsinstitute und europäischen Organisationsen für Forschung und Lehre, worunter namentlich die EUA, die European University Association, der neue, durch Fusion zustande-kommene Zusammenschluss von Universitäten, in den auch die CRE eingegangen ist.

Drittens haben wir die Beratung auf europäischem Niveau. Die Situation im Hinblick auf diese Funktion ist zum jetzigen Zeitpunkt (01-02-01) noch undeutlich und voll in Bewegung. Es sieht so aus, als werde die Europäische Kommission eine Art zweite ESTA (European Science and Technology Assembly) zusammenstellen, in der Wissenschaft und Industrie paritätisch vertreten sind. Diese ESTA-II wird sich vor allem auf Fragen von 'science policy' richten. Es ist allerdings beabsichtigt, dass ESF, ALLEA und Academia Europaea bei der Zusammensetzung eine Rolle spielen, aber wie und in welchem Ausmaß ist noch unbekannt. Im Hinblick auf die Beraterrolle in technischen und in Anwendungsfragen steht EuroCase, der Zusammenschluss nationaler technologischer Foren und academies of engineering, zur Verfügung. Auch Euroscience, ein Verbund individueller Wissenschaftler und Ingenieure, hat sich in Hinblick darauf als potentieller Ratgeber ange meldet. Und schliesslich kennen Sie die jüngste Initiative der Royal Society zur Errichtung eines speziellen Beratungsgremiums, das aus Mitgliedern von Akademien der fünfzehn EU-Länder, in Koordination mit ALLEA und Academia Europaea bestehen soll. Dieses Gremium müsste sich dann vor allem mit ethischen und politisch heiklen Problemen befassen, die eine sachkundige und rasche Reaktion vonseiten der Wissenschaft erfordern. ALLEA selbst (über den Beratungsausschuss für Wissenschaft und Ethik) würde sich aus dieser Sicht eher auf langangelegte, dauerhafte Themen auf dem Gebiet von Wissenschaft, Gesellschaft und Ethik richten.

Welche Entwicklungen im Hinblick hierauf sich auch zeigen, es bleibt die Tatsache, dass ALLEA sich das Recht vorbehält und sich die Freiheit nehmen wird, gefragt und ungefragt, Standpunkte, Urteile und Ratschläge auf dem Gebiet der Entwicklung der Wissenschaften in Europa zu formulieren. Sie wird sich eine Meinung bilden, und diese bei Bedarf äussern, zu dem sechsten Kaderprogramm, dem European Research Space, den Plänen der ESF und anderen 'science policy'-Aspekten. Sie wird sich auch weiterhin mit sozial-ethischen Fragen rundum die Wissenschaft beschäftigen; Fragen aktuellen oder mehr dauerhaften Charakters. Was Letzteres betrifft, werden ihr sowohl ständige (science and ethics, und intellectual property rights) wie Ad-hoc-Kommissionen und Arbeitsgruppen zur Seite stehen. Durch ihren

Deutschland

die teilnehmenden Akademien zurückfallen müsste. Eine dritte Möglichkeit läge darin, den Begriff `Nationalität' als Bedingung für die ALLEA-Mitgliedschaft neu zu definieren und danach zu streben, dass auch Akademien, die größere und, ganz gewiss hinsichtlich der Schul- und Universitätspolitik, politisch-verwaltungsmäßig weitgehend autonome Regionen in Europa vertreten, Mitglied von ALLEA sein können. Wenn dann einmal ein Thema auf der Tagesordnung steht, wobei nationale Interessen eine große Rolle spielen (was in den funktionellen und stark sachbezogenen Diskussionen bisher kaum vorgekommen ist), dann könnte dafür eine für alle akzeptable verwaltungs-technische Lösung geschaffen werden. Wenn Deutschland sich für dieses Modell entscheiden würde, dann wäre ich gerne bereit, einen diesbezüglichen Vorschlag in ALLEA's Steering Committee und ihrer General Assembly einzubringen und dort zu vertreten.

Referenzen


The Contribution of Science to Detente and Peace

Skopje, 2001

Introduction

In this paper the important and distinctive potential of science and scholarship for a contribution to a better and peaceful future of mankind will be discussed. Special attention will be directed to the role of Academies and Sciences and International Associations of Academies in this respect. This role is particularly apparent as they adhere to the two general and central principles, phrased in the 1996 Genoa Declaration on Science and Society as follows:

"Respect for the diversity of cultures within societies and promotion of science as a distinctive and important contributor to bridging such diverse cultures and promoting peaceful coexistence in accord with the principles of freedom, autonomy and rationality. Mutual cooperation, reflecting the recognition that the production and utilization of scientific and technological knowledge are decisive for the future welfare of humanity and that science, with its universality, is unique positioned to serve as a laboratory in which mankind can work together to achieve a better future in accord with the principles of responsibility, solidarity and respect for the rights of individuals and nations."

When Plato situated his first Akademeia in a grove near Athens, outside the centre of public life, it was rather the desire to engage in critical reflection on philosophical theorems and the political arguments than the wish for isolation that made that place most appropriate. When this Academy was closed by Justinian almost a millennium later, since the views developed there were considered to be damaging to the state, the Emperor did not realize that the very value and contribution of an Academy does spring from its search for the truth, its independent position and its freedom to criticize. Later, in the 16th and 17th century, it was this same spirit of independence

and intellectual freedom that caused the revival of the idea of an Academy as a place where scholars meet, exchange ideas and reflect in an environment of absolute intellectual freedom and independence. Of course, the ideas and recommendations produced by these intellectual activities may be used by governments, funding agencies and institutes of learning, but the Academy's primary function is that of a meeting place for independent scholarly and scientific reflection.

It goes without saying that science should be defined (and I will do so in the rest of this paper) in terms of the wider and original meaning of *scientia*, so as to cover the whole field of learning and scholarship, including the human and social sciences.

**The Forum function of science**

In the first place science and science organizations have the important forum or meeting function. Gatherings of scientists and scholars, meetings, conferences, colloquia and workshops are organized and take place in all places of the world. International contacts, reciprocal visits of scholars, special lectures, exchange of periodicals and other information, and membership of international organizations, such as ALLEA (All European Academies), ESF (European Science Foundation), ICSU (International Council of Scientific Unions), UAI (Union Académique Internationale), IAP (InterAcademy Panel) and others, further emphasize the international nature of the meeting function.

This is not to say that differences, sometimes even sharp controversies, between (groups of) scientists do not occur. Two things, however, have to be kept in mind: In the first place, these differences in opinion seldom coincide with divisions between continents, nations or political alliances. Secondly, although the debates are sometimes heated and fierce, these differences are basically agreeable to reason, and solvable - or at least discussible - in rational logical terms. Scientific differences of opinion and controversies can only be solved through reason and arguments, and never by means of power, force or hostilities. In such a dialogue it is the common search for the truth, the attempt to apprehend each other's arguments, and the joint effort to analyse and to comprehend the various issues and arguments which unite rather than divide and will lead to a common understanding.

Clearly, in this capacity Academies and alliances of Academies have an important bridging function. As it has been the case all through history,
scientific discourses seldom bother about national boundaries. Even in the
darkest times during the repressive Stalinist regime scientists from Russia
communicated with the scientists from the West. I am convinced that further
strengthening of contacts of scientists and their organizations (including aca-
demies) will further contribute to the easening of tensions between nations.

**Science as a collaborative activity**

Science has grown more and more from an individualistic to a collective,
collaborative activity. Even in the 'individualistic' days there was a strong
need for communication about research results and their interpretations. But
certainly at present science cannot exist and grow in isolation. It presupposes
cooperation and contact, the exchange of knowledge, expertise and research
results and requires a genuine attempt to understand and criticize each others
work. This criticism is also an important aspect: it is not generals or
politicians who decide what is good, but the scientists themselves. They
therefore need an acknowledged and independent platform adhered by
collegiality and solidarity.

And again these contacts and this collaboration have to cross national
borders. The international nature of science and scholarship has always been
apparent, but has become particularly conspicuous in present times with the
explosive developments of the fast and easy electronic communication
means. The term 'national science' is almost a *contradictio in terminis*. Even
for participants in national research programmes it is an unavoidable pre-
requisite to have international connections and to take part in international
collaborative networks. And, of course, Academies are full and active
partners in this (international) scientific scene. Whether they do their own
research or restrict their involvement to evaluation, stimulating and sponsor-
ing research of others, they are actively engaged in an endeavour that
furthers detente.

Here we touch upon the interesting question of why national researchers
and research institutes would engage in international collaborative research.
Let us first of all see what motivates the European Union to support this
international cooperation. Under the guiding principles of subsidiarity (no
replacement of the scientific cooperation policy of the member states),
consistency with the Communion practices, and efficiency, a few years ago
(1995) the European Union choose as specific goals for international RTD
cooperation:
- To strengthen European competitiveness and develop technologies for future markets,
- To develop partnership in S&T with neighbours of the EU,
- To share responsibility and conduct RTD on major problems of the 21st century,
- To promote RTD to foster sustainable economic growth for developing countries,
- To share S&T information and contribute to large scale and frontier science and technology.

What has the EU to say about collaboration with the most vulnerable and the least profitable mondial partners, the developing countries? In a recent presentation of the 5th Framework Program (EU, 1998) the following phrasing with respect to these developing countries has been chosen: "A policy dialogue on research and technological development needs and priorities with groups of (developing) countries and regions will be developed. Cooperation activities will be envisaged, in particular in the following areas: mechanisms and conditions for sustainable development; sustainable management and use of natural resources, including agricultural production and food security; environmental and energy aspects; health and nutrition".

It is clear that the European Union is concerned with and willing to assist the R&T developments in developing countries (EU, 1998a). The underlying motives are twofold: In part it is for its own benefit and for what may be seen as egocentric reasons: necessary participation of the developing countries in the study of 'global problems' in which they are (sometimes heavily) involved, contact with and access to new and growing markets, expansion of the scientific knowledge so as to include new phenomena or phenomena in new contexts, and certainly expansion of the know-how about natural, biological or medical processes, which are important to understand biological or medical problems in the home country.

But at the same time there is also a genuine desire to assist the developing countries that are in difficult economic conditions, and to offer them help in the form of applicable knowledge and technological skills, which may help these countries to overcome their difficulties caused by economic stagnation, by natural impediments and disasters, and by social, educational and medical arrears. Some of this can be found in official EU programmes, in accordance with Europe's desire to see improvements in the well-being of poor populations. Indirectly such support will again reduce the chances of violence, conflicts or war; we know that economic deprivation and poverty often determine or at least enforce such conflicts.
I would like to list the following arguments and motives to substantiate the need for international scientific collaboration: (see also Drenth, 1997):

(a) Mondial responsibility for the advancement of science. Some of the (major) international research programmes and projects can only be initiated and supported if sufficient international partners are involved. It is a moral obligation for countries that are capable to contribute and to participate to do so.

(b) A more egocentric need to 'keep in touch'. It is very important for researchers in any country to keep (also personal) contact with developments elsewhere. Communication and cross-fertilization is essential for the scientists' own motivation and for the education and training of younger scientists. Moreover, participation in an international research effort is often a requisite prelude to further national research.

(c) The need for studying phenomena in a transnational context. Many research issues have a supra-national scope, and less and less problems can be studied fully from a purely national perspective. Research areas such as environment, health (transferable diseases, aids), energy, transport, tourism and trade, banking and finance, and migration, to mention a few, come to one's mind easily.

(d) National interest. With respect to certain international questions a particular country may have a specific interest, because of the specific national needs. These questions may be given priority by a country on strategic ground. As far as The Netherlands is concerned (low on space, national resources, high on (educated) people, geographical position) special emphasis is given to transport and trade, telecommunication and other forms of communication (linguistics), high-tech electronics, health research and environmental research.

(e) Exploitation and further development of specific expertise. There may be some research areas where a country is able to provide an unique and profitable contribution because of its specific expertise and experience. Again with respect to The Netherlands, this may be relevant for research in the field of civil engineering (water control), agriculture and fishery, fresh and salt water interface, astrophysics, microbiology and biotechnology.

(f) Support and strengthening of R&D capabilities in less developed countries. There is a mondial responsibility for the stronger countries to assist the countries that are in less favourable conditions and with relatively weak R&D capabilities to help them to develop these capabilities. Of course this often takes the form of assistance (aid and support) instead of collaboration (mutual benefit), but in the longer run they may become stronger partners.
There is no doubt that in the very long run such aid/collaboration is the best
precondition for peaceful coexistence and balance in the world, and is thus
beneficial for the presently stronger (Western) partner.

Thus, international collaborative research can be set up and carried out for
a number of different reasons and motives, some more egocentric or
nationalistic, some more altruistic and inspired by mondial responsibility. I
dare say that such collaboration (even inspired by the first type of motives)
almost always creates better identification and understanding of common
goals, and, in the case of differences in objectives or methods, a higher
sensitivity for and appreciation of the idiosyncrasies. And, again, in a truly
scientific or scholarly dispute these differences seldom run parallel to
political disagreements and conflicts. International cooperation in research
therefore builds and enforces bridges across borders. And it is beyond doubt
that Academies, in playing an important role in fostering such international
and collaborative research, are salutary in this process.

Science as a source for advice

A third, and for the purpose of our discussion certainly instrumental function
of science pertains to the advices that are based on the research findings or
on the insights that emerge from these findings. For a proper understanding
and appreciation of many societal problems, including tensions and conflicts
between nations, a solid, objective and in depth scientific analysis of the
issues at stake can be very helpful. Also a deliberate and measured
judgement in which the scientific knowledge, including its gaps and
weaknesses, is carefully weighted and interpreted can make a valuable
contribution: it can create better and more responsible political attitudes and
promote a more accountable political decision making.

With respect to the problem of violence and military conflicts this
scientific knowledge can be twofold. Firstly knowledge of facts and
backgrounds of the issue under debate or of the cause of disagreements may
be an effective sourdine. A proper and thorough juridical analysis of the legal
claims of water, territory, air space or whatever cause of dispute can be
helpful. An objective study of the history, particularly in the many cases
where ideological leaders in international or interregional conflicts make an
appeal to historical 'rights' and 'agreements', can have a sobering effect. A
balanced comparative examination of the theological or ideological
presumptions with respect to the positions that often cause intensive religious
or ideological conflicts (Israel - Palestines, Orthodox - Islam in the Balkan area) may ease the tensions, just like an unbiased political analysis of the positions, arguments and claims of all parties involved in a conflict may do (see also Keynan, 1998).

Of course, it is obvious that we are thinking at the true scientific and scholarly approach to the analysis of the problems in question. Although I am aware of the philosophical debate and disagreements on value- and presumption-free science, the international scientific forum does not dissent with respect to the basic scientific requirements of objectivity, verification on the basis of facts, proper analysis and unbiased interpretation. The mobilization of dogmatic theology, biased history and contaminated political analyses is pouring oil into the fire. In fact, it is a matter for regret that so many scholars and scientists have lent and lend themselves to such deplorable misuse of their trade, as we have seen throughout history.

A second scientific contribution may stem from the study of the processes of conflicts, aggression and war themselves. Insight into the causes of war and intergroup conflicts, into the dynamics of violence and aggression and into the conditions that lead to injustice and oppression may be an important precondition for the development of methods for de-escalation and resolution of conflicts without resort to military action and violence. It would then also create conditions for peaceful coexistence, the protection of human rights and sustainable development.

It is particularly the behavioural and social sciences that may offer such a contribution (see for instance Wessels, 2000). One may, for example, think of organizational sciences (e.g. social psychology, organizational psychology, social engineering, organization and management sciences) that have dealt with conflict analysis and conflict management for a long period of time. A large variety of instruments and models for non violent conflict resolution and prevention have been developed. Hundreds of studies and experiments are available to allow fairly detailed conclusions on the manageability of conflicts and on the optimal conditions for their escalation or de-escalation. These studies have been published in journals like Journal of Conflict Resolution and Administrative Science Quarterly and in comprehensive books like Deutsch (1973), Rahim (1992), and Van der Vliert (1997, 1998). Many of the insights gathered in this field of research, albeit mainly focused on tensions and conflicts in and between organizations, can be applied and utilized in understanding (and reducing) conflicts between larger systems, such as regions, ethnic groups and nations.
The contribution of scientific knowledge and information to the development of standpoints and policy and to decision making can take various forms. Sometimes the scientist is (as one of the partners) strongly interwoven in the decision making process itself. Then the weight and impact of scientific arguments are difficult to trace. Sometimes (s)he is more stand-offish, for instance by applying the mechanism of conceptualisation (Weiss, 1977): redefinition of the agenda, sensitisation for problems, (re)definition of issues, or transformation of problems into non-problems.

Often research results are used as ammunition in a policy debate, either to convince the opposition or to weaken their position. Here the scientist should be particularly alert. Selective use of the data, biased interpretation of the findings, rude generalizations or plain inaccuracies are more rule than exception. Wherever possible the scientist should intervene and correct, amplify, and put the conclusions right, also in more popular media.

It is my conviction that Academies of Arts and Sciences are suitable candidates for providing such analyses and advices. The Academy's advisory capacity can be defended on three grounds. In the first place the availability of ample scientific knowledge and experience within its wall. The country's top scholars and scientists form a large reservoir of expertise which can be utilized for advice and consultancy. Secondly the impartiality and 'desinterestness' of Academy members: no political, economic, regional or professional interest group will be especially favoured in an Academy advice. Thirdly, the exclusive scientific orientation of the Academy and its advisory work: it is the promotion of science and the primacy of veracity that are its guiding principles.

A caveat is called for at this point. Scientists (and this applies also to the Academies of Arts and Sciences) always should realize their specific (modest) position and responsibilities. They could offer proper and careful analyses of the problems at hand, including the complexities, multi-causalities and non-linear relationships. They could suggest alternative options, they could give solid estimates of various 'if-then' relationships, but they should not move actively into the political field themselves. Their trade is science and that is what they should stick to. They should not try to become another political pressure group and to take over the responsibilities from the actual responsible decision makers.
The educational function of science

A last contribution of science to the promotion of peace is realized through its educational function. Training in science and scholarly education mean imparting the attitude of openness and belief in rationality and rational solutions to the next generation. In the scientific game one has to agree on rules, on proper procedures of gathering and analysing information, on the importance of collecting sufficient data and postponing definitive conclusions until further evidence has been acquired. This is what the youngsters learn. They also learn that cooperation with other scientists is essential, that new ideas are always welcome, and that listening is often more important than speaking. They start to develop networks of communication across the borders of their own nation and to utilize them through the modern media and electronic contacts. These youngsters are the future leaders, educators, authorities. Proper and responsible scientific education can be seen, therefore, as the advancement of a future culture of peace.

This educational function can even be widened to the general public. Intolerance, extremism, xenophobia, intergroup conflicts and aggression are all too often a product of ignorance. Knowledge of determinants of human behaviour and social processes, awareness of legal and economic conditions and constraints, and insight in the diversity and power of cultures and traditions are all preconditions for a better understanding, acceptance and tolerance. It is therefore fair to say that education and furthering of scientific insights and attitudes also within a broader public are important building stones for the creation of a democratic and tolerant society.

Conclusion

In this paper I have tried to show that science and scientists (including scholarship and scholars) do have an important contribution to make to the mitigation and prevention of international conflicts. First and for all by emphasizing the search for the truth, which requires an attitude of openness and communication. Secondly by emphasizing collaboration across borders as an important prerequisite for the advancement of science and scholarship. Thirdly by providing facts, information and scientific evidence which can settle differences of opinion or reduce tensions. This information can be the basis of independent and unbiased advice on policy matters which may cause tensions and disagreement. Fourthly by educating the new generation of
scientists as well as the wider public, thus increasing the intellectual defensibility and democratic foundation of a society. It is defended that for many of these contributions an Academy of Arts and Sciences (and a fortiori an international association of academies, such as All European Academies | ALLEA) may be seen (and used) as a functional and useful vehicle.

References


The Contribution of ALLEA to European Scientific Collaboration

Kiev, 2001

Introduction

ALLEA is a European network of national academies of sciences and humanities. It was created when new opportunities for cooperation arose in the 90’s due to the end of the cold war and the increasing significance of supra-national gremia (EU, European organizations and institutions) in the area of science and higher education. It has members from all over Europe, from Iceland to the Georgian Republic, from within the European Union and beyond.

Not all its members are alike. Some Academies confine their interests to natural and life sciences. Others include, or limit themselves, to social sciences and humanities. Some restrict themselves to a forum function, concentrating on scientific meetings, the exchange of ideas and opinions, the organization of conferences and symposia and international contacts. Others have, in addition, a national evaluative and advisory function. They are asked to advise on science and science policy, on quality of research and future developments, and on societal and ethical questions related to science and technology. Again others carry the responsibility for a sometimes large number of high quality research programmes or research institutes.

In spite of these differences and this variety in roles and tasks Academies have one important objective in common: the desire to promote and to develop top level scientific and scholarly research. They aim at this goal both because they believe in the intrinsic value of scientific knowledge, and because they are convinced that proper scientific research is indispensable for the desirable development of societies and the well being of mankind. The present day and certainly the future world cannot be conceived without science and technology; think of energy, new materials, information and communication, health science developments, climate and environment. But equally important for a balanced advance are philosophy, letters and history,

behavioural sciences and the study of the constituent pillars of a civil society: law, economics and social and political structures. Freedom and independence in thinking, study and discussions constitute an essential characteristic of an Academy. In fact, this was the very reason for its creation some four centuries before Christ, and for its revival and rapid dispersion during and after the Renaissance in Europe. This requires an uncontaminated scientific orientation of its members, which, of course, presupposes exclusive scientific standards for the selection of Academy members. No political, ideological or other personal or social criteria (sympathy, acquaintance, age, gender) should play a role in the submission and selection procedure. Unfortunately it cannot be irrefutably assented that throughout history or even at present this ideal norm has always been sustained. Nevertheless, the credibility and authority of an Academy stands or falls with the 'disinterestedness' and independence, and the exclusively scientific orientation of its judgments and assessments.

Let us now deal with the question of how these academies of science and humanities, and in particular associations of academies, such as ALLEA, can contribute to the cultivation of international science. In this connection we will pay attention to the aspects: collaboration, communication and science policy, and finish with some thoughts on European scientific cooperation.

Collaboration

Science has grown from an individualistic to a collective activity. It is clear that at present science cannot exist and grow in isolation, but requires cooperation, contacts and exchange of knowledge, and the opportunity to criticize, replicate or reinterpret each others findings.

And this collaboration has, of course, to cross national borders. Throughout history scientific developments and problems never bothered about national boundaries and the international nature of science has always been apparent, but it has become particularly conspicuous in present times through the widespread use of fast and powerful means of communication. Also for participants in national research programmes the need for international cooperation is undisputable. Elsewhere (Drenth, 2001) I have listed a number of arguments to substantiate this need for international scientific collaboration, including:

(a) Mondial responsibility for the advancement of science. Some of the (major) international research endeavours (CERN, ESO, EMBL) can only be
initiated and supported if sufficient partners are involved. It is a moral obligation for countries that are capable to contribute and to participate to do so.

(b) The need for studying phenomena and issues in a transnational context because of their supra-national nature and scope; phenomena that can only be studied fully from an international perspective. Research areas such as environment, health (epidemic or transferable diseases), energy, transport, tourism and trade, banking and finance, and migration, to mention a few, are cases in point.

(c) A more egocentric need 'to keep in touch'. It is very important for researchers in any country to keep (also personal) contact with developments elsewhere. Cross-fertilization is essential for the scientists’ own motivation and for the training of younger scientists. Moreover, participation in international research projects is often a requisite prelude to further national research.

(d) National interest. With respect to certain international questions a particular country may have a specific interest and may need a distinct research capacity, because of its national needs. These questions may be given priority by a country on strategic grounds and can lead to explicit national expertise. [For The Netherlands examples are fishery, civil engineering (dikes and water control), transport and trade, communication and linguistics, and high tech electronics]. This may result in an international distribution of tasks and priorities, requiring international arrangements for access and usage.

(e) Support and strengthening R&D capabilities in economically less developed countries. The stronger countries have a world wide responsibility to assist the countries that are in less favourable conditions and with relatively weak R&D resources to help them to further enhance their research and development capacities. This may often take the form of assistance (aid and support) in stead of collaboration (mutual benefit), but in the longer run they may become stronger partners. And there is no doubt that in the very long run such aid/collaboration is the best precondition for peaceful co-existence and economic balance in the world, and is thus beneficial for the presently stronger (western) partner.

There is no question but that Academies of Science, and a fortiori Associations of Academies of Science can be instrumental in the furthering of international research collaboration. National Academies can stimulate and influence the international orientation of scientists, they can provide financial means, or suggest names and contacts, they can commend
internationalisation as one of the criteria for funding, they can internationa-
lise the research carried out in their own institutes or programmes, and they
are often the national representatives in international research organizations
(ESF, ICSU, UAI, IAP and others). And it will be clear that Associations of
Academies (such as ALLEA), which are by definition operating at the supra-
national level, and the foundation of which in many cases was even inspired
by this need for international collaboration, are pre-eminently salutary in the
process of fostering the international orientation and collaborative activities
of scientists.

Communication

In the previous section it was shown already how essential communication is
for scientific collaboration. And it is this function that is one of the essential
raisons d’être of (Associations of) Academies. This communication has
necessarily a strong international dimension indeed. Gatherings of scientists
and scholars, international meetings, conferences, colloquia and workshops,
reciprocal visits of scholars, special lectures, exchange of periodicals and
other publications, and membership of international organizations all
emphasize the international nature of the meeting function of an Academy.

Of course, we see not infrequently differences of opinion, and sometimes
even sharp controversies. Three things are comforting, however: In the first
place, these differences in opinion seldom coincide with divisions between
continents, nations or political alliances. Secondly, in most scientific and
scholarly discussions the differences are basically agreeable to reason; in
normal cases they are never solved by means of power, force or hostilities.
Thirdly, it is not generals, presidents or ministers who decide what is good or
wrong, but the scientists themselves.

It is clear that for such a dialogue and debate the scientists need an
acknowledged and independent platform adhered by collegiality and soli-
darity, and in which the political or ideological pressures and powerplay are
debarked. Academies at the national level, and Associations of Academies at
the international level, are obvious candidates for such a role.
Science policy

A third function of Academies pertains to its advisory role with respect to science policy, to socio-political problems that could be solved or relieved through sensible application of research findings, or to socio-ethical problems that emerge from often controversial scientific or technological research. It is the advisory function with respect to science policy in particular that needs some more attention within the realm of our discussion. I am thinking of:

- protection advices, in which general interests, such as the protection of basic scientific research, or more specific interests, such as the promotion of social sciences or linguistics, are supported;
- structural advices, which concern for instance proposals for certain institutionalised forms of organization or funding of national research programmes, or science education plans;
- allocation advices, pertaining to the growth or decline of funding or other resources with respect to certain general or specific scientific fields. These advices are based upon quality analyses, developments in the fields concerned, or priorities set by arguments of science policy;
- research foresight advices, which are concerned with trends and developments expected or to be encouraged in different disciplines, and which could be used by governmental or other relevant institutions for the development of science policy in the future.

It will be clear that national Academies would do wise to incorporate international aspects in their science policy advices, given the strong trend towards internationalisation of scientific research in general. All four types of science policy advices mentioned would be seriously weakened if the international dimension would be wanting.

The need to embody the international dimension in the advisory capacity is self-evident for the international Associations of Academies. At the world wide level the IAP (Inter Academy Panel), and at the European level ALLEA are the suitable gremia for such science policy advices. In fact, ALLEA, with its unique character conjoining the national Academies of Sciences and Humanities in Europe, can act as an important intermediary between research and technology policy at the national and the European level. A two-way communication comes into play: On the one hand ALLEA can bring in a wide expertise and experience available within the national member Academies. On the other hand ALLEA can also play a role in 'translating' and contextualising the European policies at the national levels.
Europe

ALLEA has tried to act as such an intermediary with respect to the recent proposals of the European Commission: the European Research Area (Busquin, 2000), and the 6th Framework Programme (EC, 2001). After extensive consultation with its members ALLEA has offered a comprehensive commentary on the 6th FP proposal to Commissioner Busquin (ALLEA, 2001). I will briefly summarize this commentary and finish with a few more extensive comments made with respect to international collaboration in science.

In its reaction ALLEA has welcomed the current proposal as an important contribution towards increasing the quality of scientific research in Europe, among others by emphasizing the trans-national character of European research. Also the attention given to the relationships between research and society is highly appreciated. In this connection it is recommended that the priority area 'Citizens and governance' be broadened to 'Citizens, communities and quality of life', and that a new priority theme 'Identity and identities in Europe' be added.

ALLEA also cautions against a too narrow definition of the fields of application in the priority areas driven by scientific developments. It further recommends to keep procedures simple and transparent, and warns against criteria and procedures that unduly disadvantage smaller research groups.

ALLEA would welcome increased research funding placed at the disposal of the European Science Foundation (ESF). It also welcomes a more clear distinction between national and European research programmes (European added value) on the one hand, and a better tuning and synergy between the two types of programmes on the other. ALLEA further calls to the attention that the European Research Area needs not only funding but also adequate fiscal and legal arrangements, e.g. with respect to patents, taxes, and the mobility of researchers.

With respect to the internationalisation of research in Europe the following observations and recommendations were made: ALLEA underlines the global setting in which EU programmes operate, and values the openness towards participation by top scholars and scientists from all over the world. In fact, it finds the respective formulations in the proposal and the Explanatory Memorandum in several places to be more reserved than is considered desirable. In order to make Europe attractive and effective, drawing on the expertise available wherever in the world is most valuable.
As said earlier, FP research should have a distinctive European added value, and national programmes should continue to support disciplinary and fundamental research that is appropriate to the national and regional settings. In the long run, however, a further shift in funding from national to supranational levels might be considered. In this connection the ESF-programme for collaborative research EUROCORES is to be encouraged. As a further intermediate step national programmes might be asked to indicate their 'national added value', i.e. to make clear why certain research and development programmes are positioned at national rather than at European level.

ALLEA also stressed the wider continental setting in which the European Union programme operates, and welcomed the opportunities for participation by researchers seeking accession to the European Union. Involving states from Central and Eastern Europe, whether seeking admittance to the EU or not, is important to those countries, for the contributions their scientists can make to planned research, and for fostering cohesion and good relationships within Europe as a whole. It also increases the attractiveness of the EU as a research setting.

ALLEA appreciates the intention of engaging in specific cooperation with the Mediterranean third countries, Russia and the New Independent States of Eastern Europe, and economically developing countries, in support of EU’s foreign and developing aid policies (Explanatory Memorandum FP6, 4.1). In ALLEA’s opinion, it would be appropriate to be more liberal in allowing participation of researchers from economically less developed countries, and permitting contributions by European scientists to research and development in such countries. These countries should be able to derive more benefit from the 6th FP than they were able to do from the previous FP’s. Involving such countries is inherently necessary for studying global problems in which they are heavily involved (e.g. energy, environmental issues, infectious diseases, world population, culture and linguistics, and others) and may be beneficial for the development of science, by opening up a larger pool of participating scholars and scientists, especially when the level of education in those countries rises.

Creating better opportunities for their participation is not merely a question of fairness to them, but will also benefit science itself by involving a larger number of competent researchers, and by a more complete coverage of the issues under study. It is ALLEA’s opinion that, if the FP mechanisms are considered or turn out to be inadequate for encouraging scientific cooperation of the European Union countries and accession states with the New Independent States and the 'third world', a special EU programme
should be established, dedicated to such development cooperation in research and higher education.

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Quality Assessment: 
A Challenging Task for Academies of Sciences

ALLEA, 2002

Definition and measurement

Quality seems to be a key word in many present day deliberations on science policy and science promotion. Whether the objectives of European institutes and networks, Framework Programmes or collaborative research projects, or the guidelines for a European Research Council or new initiatives of ESF or EUROHORCS are being discussed, the criteria 'quality' and 'excellence' almost unavoidably earn the highest priority. Quality has an undoubted and nearly holy status.

A few decades back De Groot made a similar observation. He begins an interesting discussion on the question whether quality of education can be measured by referring to the fact that when the word 'quality' crops up, critical reasoning usually stops and contention is silenced. We all want quality. "The word is a dubious refuge to cover up the uncertainties and differences in what we actually mean" (1983, p.57).

Quality is a concept with a variety of different meanings. One should continuously demand specification if one intends to use it in scientific or policy analysis. It will then be apparent that the term is employed in different contexts and on different levels of complexity and abstraction. This is still true in the present day debate on the quality of education and research. The pre-eminence of the concept meets very little opposition, but at the same time it is often used in an undefined and multifarious fashion. An example from every day language, the expression "We shall attempt to keep the patient alive as long as possible, but not so that it is to the expense of the quality of life", refers to a concept of quality that is far more general and also more difficult to deal with than when one speaks of the quality of a computer or help desk service. In organizational science 'quality' in the sense of 'quality control', 'quality guarantee', 'product quality' is rather concrete and can be measured by means of the specific characteristics of the product to be manufactured or the service to be delivered. However the expression 'quality of work', which has been in vogue for some 30 years now, and which refers to the attempts to give work a more humane character through restructuring of tasks, delegation of responsibilities, stimulating autonomy and task enrichment, has a much higher level of abstraction.
The concept of quality (and its assessment) can, therefore, be handled at a low level of abstraction, leading to simple, often only quantitative specifications and operationalisations. Quality of research can then be attached to one (or more) single, simple measure(s): the number of publications per year, or the number of patents, invitations, rewards in a given period. Likewise, quality of education can be assessed in this vein by the number of graduates per year, the relation between inflow and outflow of students, an average score on a student questionnaire evaluating a course or training offered, etc.

Quality can also be handled as a complex concept. It cannot then be defined in simple terms. The final evaluation of this type of quality will be a multiple assessment of the constituent elements that can occur in varying interrelationships and interactions. In general, this approach will provide a more useful basis for understanding the complexity of multi-faceted phenomena like quality of research or education. For such an understanding, it is then necessary to clarify which elements comprise this notion of quality. In all likelihood, one is forced in such an analysis to divide the concept still further into sub-concepts.

Why quality assessment?

The general question may be posed, why the concern for quality and quality assessment in universities and research institutes should be given such a high priority. The following answer to this question can be formulated:

First and before all there is the fact that a researcher always remains accountable. This starts already with the publication of experimental or analytical results, and the presentation of the findings to the scientific forum. Accountability vis-à-vis the scientific community, and often even to the public at large is inherent in the scientific venture and implies an essential motive for the evaluation of research.

A further answer to this question stems from the recognition of the importance of scientific research for the society. It is generally recognised that preservation and further advancement of the present day welfare society cannot be guaranteed without a major contribution of the national research and development efforts. And this regards the whole spectrum of sciences and humanities. Economic and social progress depends to a large extent on the creation, testing and application of new ideas, insights and theories on the nature of and connections between natural phenomena, on social, economic and legal structures, as well as on the cultural and spiritual products of the
human mind. And it needs no argument that maintaining quality criteria and high standards is a sine qua non for this significant contribution. However, in the third place, scientific research has become increasingly costly. The experimental equipment needed in modern life sciences, the advanced apparatus being used in physics and chemistry of today, the large scale data collection and handling in social sciences, and even the growth of high tech informatisation in letters and humanities all demand expensive investments in both personnel and equipment. Naturally Research and Development cannot distrain on an ever increasing slice of the national cake. In fact, research budgets of universities and research institutes have been under pressure for quite some time now in many European countries. And given these economic constraints national Research Councils and Boards of universities, academies, and research institutes are constantly compelled to make choices and to set priorities. It will be evident that the quality of research will be one important parameter in making such choices.

It will also be evident that, although for scientists quality is the major, and often the sole criterion for such a choice, this cannot be the case for governments and governmental institutions. A democratically elected and controlled government cannot be denied the right or even the duty to set priorities for the distribution of resources to different scientific fields as well as the choice of societal or economic problems to be researched on the basic of deliberate socio-political considerations. In fact, this is the basic justification for a system of strategic research.

Aspects of quality

In the first section it has been pointed out already that quality can be defined and measured at a low level of abstraction, or can be seen as a complex and abstract concept. In our view the latter approach is more fruitful in speaking about quality of research or education. But, of course, for assessment purposes quality has then to be specified and defined in sub-concepts so as to avoid subjective, global and therefore unreliable evaluations.

In a later section we will present an example of quality assessment, carried out by an ALLEA task force, and there we will go further into the matter. At this moment I would plead to be relieved from the impossible task of defining quality of scientific or scholarly research in a comprehensive and generally applicable way. Let us just repeat that quality can best be seen as a multi-dimensional concept, in which two main elements are to be incorpora-
ted: an element of competence, originality and intellectual contribution to science, to be judged by intrinsic standards, and an element of relevance or contribution to the society, as judged by external, more utilitarian criteria.

Given this multi-dimensional character of research no single or simple available performance indicator, such as number of publications, some citation index, number of graduates, or number of patents will suffice. The more complex a phenomenon to be evaluated, the more we have to rely on judgemental processes, in which both quantitative and qualitative data are combined. In this connection it should be stressed that the well known and often criticized peer review procedure, fallible as it may be at certain points, continues to play a significant role in quality evaluation.

With respect to the second element, the societal relevance, the following point of view needs to be emphasized. It would be most inapt to think that this element refers only to applied research and technological development, and to narrow the concept of societal relevance to practical usefulness, or, even worse, to economic utility. In fact, a sophisticated conception of relevance applies to the whole range of basic to applied research. We would like to distinguish the following four types of 'relevance':

In the first place intrinsic relevance, which goes beyond the economic value and practical applicability. Research, be it in the natural sciences, in the humanities or in the social sciences, leads to an augmentation of the body of knowledge, an intrinsically valuable and precious quality of civilization. Raising questions on the nature and determinants of observed phenomena is a fundamental and unique characteristic of the human species and a motor for its development.

It is clear that the continuity of this scientific discourse appears to full advantage in dialogue with the next generation. In other words, intrinsic relevance is strongly related to the educational mission of science: the transmission, re-evaluation and further development of scientific knowledge in training and education, and the enrichment of the next generation with knowledge and insight.

Secondly instrumental relevance, the immediate or indirect application of research through the transformation of its findings into practical tools and instruments. Applied science research has resulted in an abundance of such devices and techniques: measurement devices, analytical techniques, tests, drugs, diagnostic aids, but also means to influence people, to support decision making and to direct or change societal systems.

In the third place innovative relevance. This type of relevance refers to the contribution which scientific research can make to the creation of new
knowledge and insights, which may lead to important breakthroughs in technology and development. It should be emphasized that, while instrumental relevance is often a product of what is called applied or problem driven research, this certainly is not always the case with respect to innovative relevance. Also pure, 'curiosity driven' research may turn out - sometimes unexpectedly and unintendedly - to be highly 'practical'. Pure research can lead to surprising applications, sometimes many years later. A few well known illustrations prove this point: the development of computer topography in the 50's was based on the at the time over 40 years old Radon theory, the application of polymer chemistry in plastics manufacture took place more than 30 years after its formulation, and time lag between the development of Marconi's telegraph and Maxwell's grounding work on the transmission of electronic waves was also more than 25 years. In fact, it is this train of thought that has called in question the usefulness of the classical distinction 'basic - applied science' with many philosophers of science today.

The fourth form of relevance can be called *contributive* relevance. Here the aim is not instrument development or technological innovation, but rather to support or to contribute to decision-making and policy development on the basis of scientific findings. The visibility of the involvement of the scientist can vary from almost untraceable to explicitly recognizable: The scientist can be actually one of the partners in the decision-making or policy-formation process; the research results can be used as ammunition in a discussion or debate, either to defend or to attack a certain position, or to create positive or negative attitudes with respect to a certain stance or view; or the scientist could be asked to bring in his/her expertise in the various phases of policy formation or decision-making. This expertise can of course originate from basic research as well as from applied problem-driven research.

What we have tried to make clear is that 'relevance for the society' has many faces and can mean quite different things, and certainly refers to more than technological development. Scope should be left for research that is generated by intellectual curiosity and which aims at the augmentation of knowledge and insight as such, no matter whether this refers to phenomena in the universe, the earth system, human or animal behaviour or cultural products like languages, economic or legal systems. Also the reflection upon the nature and meaning of things, as is realized in philosophy and theology, falls within this ken.
Criteria for quality assessment procedures

An important question to be considered in designing an assessment procedure is which criteria should be met in choosing or developing instruments or indicators of quality. The following criteria can be listed (see e.g. Drenth, 1986):

Relevance. This concerns the degree to which an index or rating instrument adequately represents the goals or the performance domain that the assessment hopes to cover. Two major questions arise here. Firstly, whether the essential elements of the intended goal are sufficiently accounted for. If that is not the case we speak of deficiency. Secondly, whether it can be taken as assured that no aspects are included that do not belong to the area of the phenomenon to be assessed. In that case we speak of excessiveness. A rating system for quality of research in which only quantity of output is measured is deficient, and a system that includes students' ratings of teaching quality may be excessive, since quality of teaching may not be part of the defined domain 'quality of scientific research'. The relevance of a system of assessment is therefore mainly determined by the question to what extent deficiency and excessiveness have been avoided.

Validity. This refers to the, empirically testable, question whether an instrument or scale, intended to ascertain a certain characteristic or quality, actually does measure this characteristic or quality. Peer rating of project proposals may serve as an example. The extent to which the real quality of the proposal is rated indicates the validity of peer rating. The extent to which such ratings also reflect reputation of the institute in which the author works, the quality of the English of the proposal, or age, gender or nationality of the author invalidates peer rating.

Reliability. This notion refers to the degree to which all kinds of coincidental influences or error factors are eliminated from a given method of assessment or measurement. Ideally two independent ratings should result in identical scores. It is clear that mostly objective, quantifiable data are more reliable than subjective, "softer" data. On the other hand these objective quantitative data are often more vulnerable in view of the demands set by relevance and validity. In many cases, one is forced to take refuge in the more subjective methods in order to guarantee sufficient relevance and validity.
Transparency. This criterion refers to the degree to which the process of making the assessment and evaluation is clear and unambiguous. Which elements constitute the final assessment, and how much weight is attributed to these elements should be transparent for those involved. The argument for this criterion is threefold. First, transparency is a general requirement that can be set for all inferences and judgements. Inferential processes and elements in evaluation should be made as explicit as possible in order to create a rational, analysable and improvable procedure. Second, assessments often have consequences: measures will be taken, sometimes with serious consequences for the organization, personnel or finances. People affected are entitled to have insight in the process of evaluation and the weighing of various elements one against another. Moreover, in case of unpleasant consequences for individuals, the possibility of appealing against such measures should be offered, which once again means that the grounds on which the evaluation rests should be made explicit. Third, the objective of an assessment is often improvement. And there is the learning principle that feedback for learning and improvement should be specific. Qualities and shortcomings should be presented in a clear and detailed manner, if a modification of behaviour in a desired direction is aspired to.

Acceptability. This criterion is not totally different from the previous one. Totally non-transparent procedures are generally unacceptable for the people involved. Of course, the reverse is not necessarily true: high transparency is no guarantee for acceptability. What has been said about the importance of transparency for feedback and improvement is also true for acceptability. Change and amelioration can be best achieved if the basis on which the assessment rests is acceptable for the institution or the individual concerned. Also the problem of consequences is an important factor in this discussion. The more serious these consequences are for those involved, the greater the demand for acceptability. People are less disturbed by less acceptable criteria for a scientific prize or small grant than by such criteria used for the evaluation of their institute or department.

Role of Academies

In my view Academies of Sciences and Humanities (and international Associations of Academies, such as ALLEA) are proper organizations to take upon them under certain circumstances the responsibility for the
assessment of scientific research quality, as described above. In addition to a platform and meeting function, to the administrative responsibility for research, carried out through Academy-projects or in Academy institutes, and to the advisory function with respect to the promotion of science a fourth allotted task for the Academy may be an evaluative function; evaluation of individuals (prizes, scholarships, fellowships), programmes (research programmes, proposals for graduate schools), and institutes (research institutes within universities or other governmental organizations).

This evaluative function of an Academy can be defended on three grounds. In the first place the availability of the profuse scientific knowledge and experience within its walls and within its advisory councils and committees. Secondly the impartiality to be expected of the Academy members. With a serious and responsible Academy no political, economic, regional or professional interest group can nourish the hope of being especially favoured in Academic judgements. Thirdly the exclusively scientific and scholarly orientation of the Academy members: it is the promotion of good science and scholarship that determines their choices and judgements.

At this point it may be appropriate to have a closer look at the distinction between this 'Academic' evaluation function and the equivalent function of National Science Foundations or Science Research Councils. A number of years ago the Dutch Academy of Sciences (KNAW) and the Dutch National Science Foundation (NWO) concluded that the tasks of both agencies could be best divided along the lines separating evaluation ex ante from evaluation ex post. NWO evaluates proposals for projects, programmes and individual activities, to be financially supported in the future, and therefore works in a prospective context. The Academy evaluates whether and to what extent objectives set out in the past have been achieved and assesses the performance and achievements retrospectively. Of course, the distinction is not a 100% discriminant function, and does not preclude some of the Academy evaluations to have predictive connotations, and the ratings of NWO to be based on past performance as well.

A similar situation occurs at an international level. Take Europe as an example. More and more institutions, projects, programmes, and collaborative networks in Europe dissociate themselves from the national perspective and have a real supra-national, sometimes pan-European character. The same is true for European research efforts as initiated by the European Commission (Framework Programmes) and for instance the European Science Foundation (ESF). Here the need for an einmalige or periodic
independent evaluation will be felt as well. It is my view that ALLEA as the federation of National Academies in Europe can fill up the hiatus and offer its expertise for such evaluations. ALLEA evaluation committees or evaluation committees composed by ALLEA and selected from the rank and file of Academicians, can fulfil a similar function at the European level as National Academies fulfil within their own country. It is in this context that I as President of ALLEA have asked the member Academies to nominate up to five Academicians who would agree to be approached for such a review activity. ALLEA would then have a pool of potential reviewers to draw on should the need arise.

There is still another advantage for the creation of such a pool of reviewers. We see a growing tradition of inviting foreign experts in national review committees. This is to be encouraged, since this will contribute to further internationalisation and counters provincialism through international benchmarking. Here again ALLEA members may pay each other a service through the availability of foreign expert reviewers.

An example

Late 2001 the European Science Foundation (ESF) approached ALLEA with the request to review the structure, operations and achievements of the Standing Committees on Social Sciences and Humanities. The year before the Standing Committees for Life and Environmental Sciences, and for Physical and Engineering Sciences, as well as the European Medical Research Councils had been reviewed by the Royal Society of London.

Terms of reference included the task to evaluate the operations of the two Standing Committees within the overall ESF structure, to consider the effectiveness, impact and recognition within the wider European scientific community, the operation of links with ESF Member organizations, to consult with relevant key respondents, and to report to the ESF Governing Council, through the Executive Board. ALLEA saw this request as an interesting challenge, and as an opportunity to acquire some experience in this area. Its proposal with respect to the design, personnel and financial requirements and the time schedule was accepted by ESF and the activities started beginning 2002. The following aspects of this evaluation exercise deserve attention:
(1) Personnel. Given the wide theoretical and methodological differences between social sciences and humanities, it was decided to compose two review panels. Suitable chairmen for these two panels were recruited from the Dutch Academy. Both candidates accepted this responsibility. The actual review committee would exist of the sum of the two panels, while ALLEA’s President would serve as a linking pin between them.

The Member Academies were then asked to nominate possible candidates for the review panels. From these suggested pool of names the actual members of the two panels were selected, where possible making allowance for a proper distribution of region, discipline, and gender. The proposed composition of the panels was accepted by ESF.

A staff member of the Dutch Academy was disposed to act as secretary of the SCH panel, and as secretary of the SCSS panel an external professional, who would also be able to bring in expertise in survey research and science policy analysis, was employed.1

(2) Design. The following design and time schedule was developed for the review.
- Until end May, 2002: Gathering of initial information through document analysis and interviews with some key-informants, such as present and previous secretaries of the SCSS and SCH. Completion of preliminary overviews of both standing committees. Preliminary definition of the main issues.
- Until end June: Consultation with Royal Society of London and other experts on previous reviews of science panels. Development and evaluation (with both panels) of design and methodology framework. Defining populations from which samples had to be approached with questionnaires, viz. Standing Committee Members, Member Organization Representatives, and Recipients (of ESF grant or support). For each population a specific questionnaire was to be designed. Selection of key-informants for in depth interviews.
- Until end July: Construction of Questionnaires and pilot testing.
- Until end October: Distribution of questionnaires, monitoring returns. Preliminary analysis of results, constructions of summary tables, and preparing first reports for the two panels. Identifying issues for further in depth

1 Here we like to express our appreciation to this external researcher, Dr. Heide Hackmann, for her organizational and intellectual input in the design and execution of the review.
interviewing. Development of interview-schedules. Conducting the interviews.

- Until end November: Integrated analysis of the quantitative and qualitative data from the surveys and the interviews. Preparation of a draft report to be discussed at the panel meeting half December.
- Until half of January, 2003: Writing the final draft. Submission to the ESF.

(3) A Matrix of Evaluation Variables and Questions.
In the first section of this article it was defended that quality could best be conceived as a complex concept that needed to be further parsed in distinct sub-dimensions. Here we present an example of such an analytical specification (the matrix is adapted from Arnold and Balazs, 1998). First we have identified which generic evaluation variables had to be distinguished. The following units were identified:
- Policy, referring to the objectives, priorities and decisions (against which other evaluation units are examined);
- Resources, including financial resources, skilled personnel, expertise, capacities, instruments and infrastructure;
- Structure, referring to the organization, composition of tasks and responsibilities, relationships, division of labour;
- Process, the way the unit to be assessed operates, its functioning and management;
- Outputs, the direct results and products of this unit;
- Outcomes, referring to the effects of the outputs, the changes and benefits resulting from their availability.
Secondly the following generic evaluation questions were distinguished:
- Appropriateness, in which the question is asked: Is this suitable or the right thing to do? Appropriateness also includes the notion of adequacy;
- Effectiveness: Has it produced the expected results or effects?
- Efficiency: Does it function well or optimally, given the relation between input and output?
- Quality: How good or how satisfactory is it? (It will be noted that 'quality' is used here in a more restricted sense of an evaluation category, and not in the broad sense as implied in the title of this essay).
- Impact: What has happened as a result of it?
- Additionality: What has happened as its result over and above what would have happened anyway?
- Improvement: How can it be made better or strengthened, to which degree is there need for improvement, which changes have to be made?
The combination of these two sets of variables and questions leads to a matrix of Generic Evaluation Questions applied to Units, as visualized in Figure 1.

<table>
<thead>
<tr>
<th>Variables Related to</th>
<th>Questions about</th>
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<tbody>
<tr>
<td></td>
<td>Appropriateness</td>
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<tr>
<td>Policy</td>
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<tr>
<td>Resources</td>
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<tr>
<td>Structure</td>
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<tr>
<td>Process</td>
<td></td>
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<tr>
<td>Outputs</td>
<td></td>
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<tr>
<td>Outcomes</td>
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*Figure 1.* Generic evaluation questions applied to units (adapted from Arnold & Balazs, 1998).

This matrix has been used to guide the construction of the questionnaires and the interview schedules, and as a basic framework to evaluate the various units and responsibilities of the two ESF standing committees. As far as the latter are concerned four separate categories to be evaluated were chosen: viz. the Standing Committee's Secretarial Unit, The Standing Committee in General, the Scientific activities, and Science Policy Activities, including the Forward Looks.

Of course, the 'units' in the generic matrix had to specified for each of the four categories. For instance the 'policy' unit for the Secretariat included budgetary planning, soliciting of applications, implementation of SC decisions, contact with Member Organizations, international networking, publicity, and policy development, whereas the 'policy' unit for the Standing Committee in General referred to its main tasks, such as budget accountability, maintaining links with other SC and/or ESF Units, contact with Member Organizations, international networking and publicity and marketing. Likewise, the 'resources' unit for the Scientific Activities is composed of its instruments, viz. exploratory workshops, networks, scientific programmes, EUROCORES, EURESCO conferences, and other (a.o. transatlantic collaboration), whereas this 'resources' unit for Science Policy Activities included the instrument Forward Looks, and the science policy skills and expertise of the Member Organizations. Not all evaluation issues
and all units are equally relevant and important for all four Standing Committee categories to be rated. In fact, an eventual scoring of all cells in the matrix for all four categories would be both impossible and to a large extent useless. It was therefore decided that only the most relevant 'cells' of the matrix would be selected for each of the four categories. This was accomplished by the two panels for the Social Sciences and Humanities separately. Throughout the review process these 'purged' matrices have served as important guidelines for the focusing of the research attention to the relevant questions and issues.

Conclusion

In this article it was shown that 'Quality' will remain to be listed as one of the most salient criteria in reviewing educational systems and science research. At the same time it was defended to dissociate the concept of quality from the sphere of slogans and political catchphrases, and to define the term in logical and empirical terms. It was also shown that quality of more complex systems had to be assessed with the help of both quantitative indicators and qualitative, judgemental ratings. Important conditions for proper reviewing are expertise, independence and a strict scientific orientation. It was argued that Academies of Sciences and Humanities, and, at a European level ALLEA as the European Federation of Academies, would be suitable institutions to be invited for such quality assessment exercises. The review of two Standing Committees of the European Science Foundation was described as an example of such an endeavour.

References

Drenth, P.J.D. (1986). Quality in higher education - evaluation and promotion. CRE-Information, 18, 57-69.

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### Appendix

**Acronyms and Abbreviations**

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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ALLEA</td>
<td>All European Academies; the European Federation of National Academies of Sciences and Humanities</td>
</tr>
<tr>
<td>DG</td>
<td>Director(ate) General (European Commission)</td>
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<tr>
<td>EACH</td>
<td>European Academies Clearing House</td>
</tr>
<tr>
<td>EARMA</td>
<td>European Association of Research Managers and Administrators</td>
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<tr>
<td>EARTO</td>
<td>European Association of Research and Technology Organisations</td>
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<tr>
<td>EASAC</td>
<td>European Academies' Science Advisory Council</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<td>EFCS</td>
<td>European Federation of Chemical Societies</td>
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<td>EMBO</td>
<td>European Molecular Biology Organisation</td>
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<td>EMF</td>
<td>European Materials Forum</td>
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<tr>
<td>E-MRS</td>
<td>European Materials Research Society</td>
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<tr>
<td>EPS</td>
<td>European Physical Society</td>
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<tr>
<td>ERA</td>
<td>European Research Area</td>
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<tr>
<td>ERC</td>
<td>European Research Council</td>
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<tr>
<td>ESF</td>
<td>European Science Foundation</td>
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<td>EUA</td>
<td>European University Association</td>
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<tr>
<td>EuroHoRCs</td>
<td>Heads of research Councils in Europe</td>
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<tr>
<td>FP</td>
<td>(European Commission) Framework Programme</td>
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<tr>
<td>IAA</td>
<td>International Association of Academies</td>
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<tr>
<td>IAP</td>
<td>InterAcademy Panel</td>
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<tr>
<td>ICSU</td>
<td>International Council for Science</td>
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<tr>
<td>ISE</td>
<td>Initiative for Science in Europe</td>
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<tr>
<td>IUCA</td>
<td>International Union of Academies</td>
</tr>
<tr>
<td>KNAW</td>
<td>Royal Netherlands Academy of Arts and Sciences (Koninklijke Nederlandse Akademie van Wetenschappen)</td>
</tr>
<tr>
<td>NAS</td>
<td>National Academy of Sciences</td>
</tr>
<tr>
<td>NEST</td>
<td>New and Emerging Science and Technologies Sciences and Humanities in Europe</td>
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<tr>
<td>NWO</td>
<td>Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Netherlands Organisation for Scientific Research)</td>
</tr>
<tr>
<td>STEPS</td>
<td>Science, Technology, Engineering, Policy and Society</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organisation</td>
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