RICHARD ERNST

Richard R. Ernst was full Professor of Physical Chemistry since 1976. He directed a research group devoted to magnetic resonance spectroscopy, was director of the Physical Chemistry Laboratory of the ETH Zurich and retired in 1998.

He was president of the Reseach Council of ETH Zurich and he is presently, among other duties, a member of the Swiss Science Council, of the COST Committee, of the Foundation Marcel Benoist, of the Hochschulrat of the Technische Universität Munich, and Vicepresident of the Board of Bruker AG, Fállanden. He is on the editorial board of 10 scientific journals.

He received numerous honours, including the Nobel Prize for Chemistry (1991), the Wolf Prize for Chemistry (1 99 l), the Horwitz Prizc (1 99 l), and the Marcel Benoist Prize (1986). He reccived honorary doctors degrees of ETH Lausanne, Technische Universität Munich, Universität Zurich, University Antwerpen, Babes-Bolyai University, Cluj-Napoca, and University Montpellier. He is a member of the US National Academy of Sciences, of the Royal Academy of Sciences, London, of the Deutsche Akademie Leopoldina, of the Russian Academy of Sciences, of the Korean Academy of Science and Technology, and honorary member of many further societies.

Resumen de la Conferencia

La comunidad global se encuentra actualmente en una encrucijada y hay que tomar decisiones con vistas a un futuro próspero. Si bien la prosperidad en los países del oeste es mayor que nunca y nuestros lujos son muchos, parece poco probable que las tendencias actuales en economía global y en las relaciones entre países desarrollados y en vías de desarrollo puedan mantenerse por un tiempo ilimitado sin producirse serios problemas a escala global.

La economía libre de mercado, como concepto general, ha sido nuestro guía en casi todos los aspectos de la vida y de relaciones humanas. La economía libre de mercado está fundamentada en la competitividad, siguiendo esencialmente los principios de la selección natural de Charles Darwin. Pero los sistemas económicos son de una enorme complejidad e incluyen retrasos increíblemente largos antes de que los efectos perniciosos, por ejemplo en términos de recursos naturales esquilmados, sean aparentes.

La naturaleza aparenta ser algunas veces muy tolerante y permisiva. También la naturaleza humana es básicamente tolerante, adaptable, y permisiva. Pero la venganza retrasada puede ocurrir de repente, por sorpresa, y a menudo de forma muy brutal. Hasta este suceso, uno se siente seguro continuando las malas prácticas que darán lugar, al final, al desastre inesperado. Hoy en día podríamos estar en una situación así de peligrosa, viviendo significativamente por encima de nuestras posibilidades.

Es improbable que los líderes industriales o políticos adopten iniciativas para realizar cambios, o simplemente para un análisis crítico de los peligros de las actuales tendencias. Corresponde a la comunidad académica de las universidades el analizar críticamente las tendencias actuales en economía, política y estilos de vida, con vistas a un futuro prospero y duradero de nuestro planeta, de avisar a la comunidad, y de dar un asesoramiento constructivo. Sólo las universidades y los profesores universitarios tienen la libertad necesaria y los recursos para estudios objetivos e imparciales. Pueden establecer sus propias prioridades y encontrar el tiempo necesario para concentrarse en asuntos vitales.

La ciencia y los científicos se han vuelto extremadamente especializados, por necesidad. Sin especialización y sin concentrase en los detalles esenciales, el progreso ya no es posible. Ningún científico por sí solo puede encontrar soluciones duraderas en el dominio de los sistemas eco-

nómicos y sociales globales. Para dar un asesoramiento fiable en una mejor organización global de la sociedad requiere la colaboración de muchos, sino todos los científicos, incluyendo los representantes de las humanidades y artes liberales. Ello implica disponer de algunas pautas para facilitar ese debate en las universidades.

Ruego porque las universidades se conviertan nuevamente en centros de estimulación para la renovación de la sociedad y centros de pensamiento para tratar cuestiones de importancia global y a largo plazo. Me gustaría mencionar unas pocas cuestiones pertinentes que podrían discutirse en nuestras universidades con vistas a un desarrollo sostenido en el futuro de la sociedad:

- Crear un nuevo sistema ético que combine el conocimiento científico con la compasión y los valores culturales.
- Desarrollo de nuevos conceptos para las estructuras supranacionales que permitan regular el comercio internacional y las relaciones políticas y el uso de recursos.
- Transición desde una "economía libre de mercado" a una "economía responsable de mercado" basada en principios éticos generalmente aceptados.
- Mejora de la suerte de los países del tercer mundo en una economía responsable de mercado.
- Reestructurar las universidades para dominar los futuros desafíos.
- Cómo "dirigir" los esfuerzos de investigación para el mejor apoyo a largo plazo a la sociedad.
- Cómo "proporcionar" una educación óptima del público en general en temas de ciencia.

Estoy convencido que la actual ausencia de un adecuado número de estudiantes en ciencia está parcialmente debida a la extrema especialización científica y a la falta de habilidad de los científicos para expresarse ellos mismos en términos simples de relevancia general. Si la indispensable demanda de detalles pudiera combinarse con una discusión de cuestiones de relevancia universal y social, los estudios científicos podrían atraer también a estudiantes que no quieren perder la conexión con el contexto social. A menudo, estos son nuestros pensadores más profundos y creativos. Las universidades y la sociedad les necesitan urgentemente en las ciencias para ayudar a resolver algunos de los problemas que nos esperan en un próximo futuro.

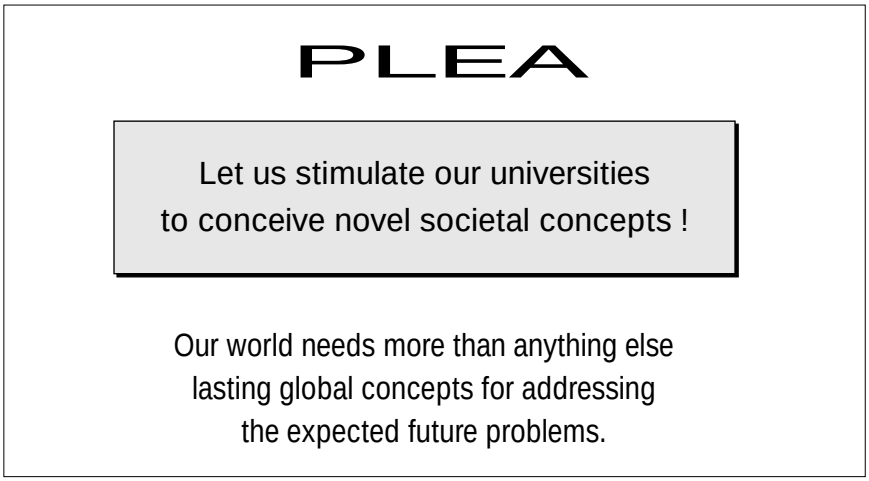
Uno de los mayores desafíos a resolver por la comunidad científica es el de comunicar la ciencia al público en general. No es solamente una cuestión de supervivencia y de alimentación adecuada a la ciencia, sino una cuestión de uso racional de los medios técnicos disponibles y facilidades por el público con vistas a la sostenibilidad. No podemos esperar un comportamiento racional cuando el conocimiento y la comprensión requeridas no existen. Depende de la comunidad científica el tomar la iniciativa para un mayor esfuerzo educativo en esta dirección.

Conferencia

RESPONSIBILITY OF SCIENCE AND SCIENTISTS

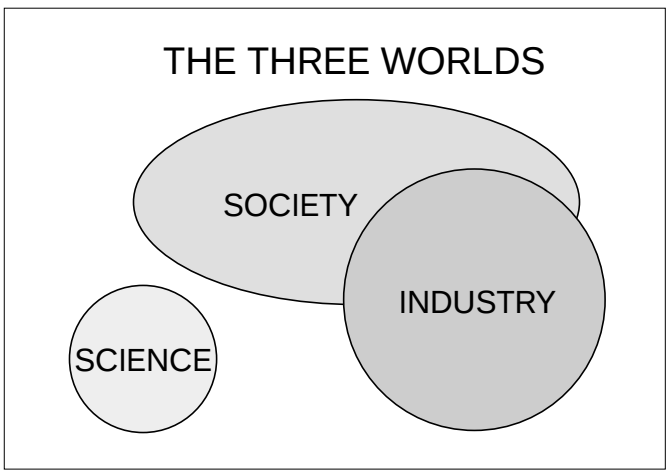
The turn of the century and of the millennium give us an opportunity to reflect on the proper pathway to be taken by humankind and on the destiny of our globe. "Science, technology and society", is a very relevant subject in this context. It has caught my interest for the past fifty years, actually since the beginning of my studies. I can not present here final answers to perennial questions. Probably, I will rise more questions, than I can give answers: Which is the pathway we have to chose to warrant a prosperous future of the entire humankind? How can we protect the rights of the weak members of humankind? How can we reach true sustainability? What precautions do we have to take to prevent a premature destruction of our civilized world by the flames of our ignorance and our thoughtlessness?

The essence of my lecture can be summarized in a simple plea put at the address of the academic community:



Indeed, in spite of the enormous importance of scientific research, I think it is more relevant to search for lasting global concepts, which take into account the expected future problems, than to work out more and more details without a clear context of relevance. This is virtually all I have to say in my lecture. The remainder boils down to ornaments, a little bit of artificial sweetener, and a little bit of pepper. As you know, the less one has to say the longer will be a lecture! If I am known for anything, then for a vivid proof of this truism.

For the discussion today, I would like to represent our civilized universe by a vehicle running on two wheels. The front wheel represents science, which should determine the direction in which the vehicle is moving. Science, with its profound wisdom and its foresight, is supposed to guide society into a glorious future, full of wealth and (useless) gadgets. The scientific front wheel is shown a little bit detached, as it has, sometimes, a tendency to roll away, without much contact with the precious freight of the vehicle, our society. Its motion may be motivated more by science-inherent goals than by its function of guiding the vehicle.



The vehicle possesses a powerful back wheel that represents industry, providing the propelling power. It is running faster and faster every day. It is rotating as long as there is fuel left. The back wheel is sufficiently big and strong not to be impeded by obstacles on the road, just going straight ahead into a profitable future, or perhaps going directly to hell.

And the fellow-passengers, our dear society? They enjoy the speedy ride, they drink champagne and hope for further gains at the stock exchange. They throw out plenty of sweets for appeasing the poor and the disfavored ones, which are carelessly run over, after having spoiled their stomach with the unhealthy sweets. Very rarely only, the passengers become aware of the problems they are causing themselves. Sometimes, they blindly accuse science and industry for all the problems, which they are running into by their own faults. Indeed, the relation between science and society is truly schizophrenic. Technology is taken for granted and exploited without any second thoughts. On the other side, science and technology are accused to be the major evil that leads us towards the ultimate disaster.

I will concentrate my lecture on the tasks of the universities for preventing a disastrous future. The basic obligations of universities, I would like to summarize by three fundamental tasks. The first two are wellknown and generally accepted: (i) research, leading to inventions and innovation, and (ii) education, understood in a very broad sense to be defined later. (iii) I want to add a third task, which I think is at least of equal importance: The responsibility of formulating innovative concepts for the societal development, in view of a long-term prosperity of the global society. It requires the formulation of a novel universal ethical framework, a search for improved societal and particularly international structures, and new considerate and sustainable approaches to international commerce.

Research and innovation

Let me say, at first, a few words on research. You know that research can be motivated in different ways: Research driven by the researcher's curiosity is certainly most near to the heart of any scientist. Fascinated by the phenomenological wealth of the universe, scientists can not cease to explore its secrets. On the other hand, society and industry rather expect problem-oriented research, research efforts that solve some of the urgent problems that torment humankind. And finally, we have also to mention program-guided research, as requested by politicians who try to coordinate the seemingly unrelated research efforts and to imprint upon the research programs their own stamp by a top-down approach. Politicians are often afraid that scientists are not collaborating enough and merely satisfy their own personal goals.

At present, scientists are torn back and forth between these three demands. But most of them agree with Linus Pauling who said:

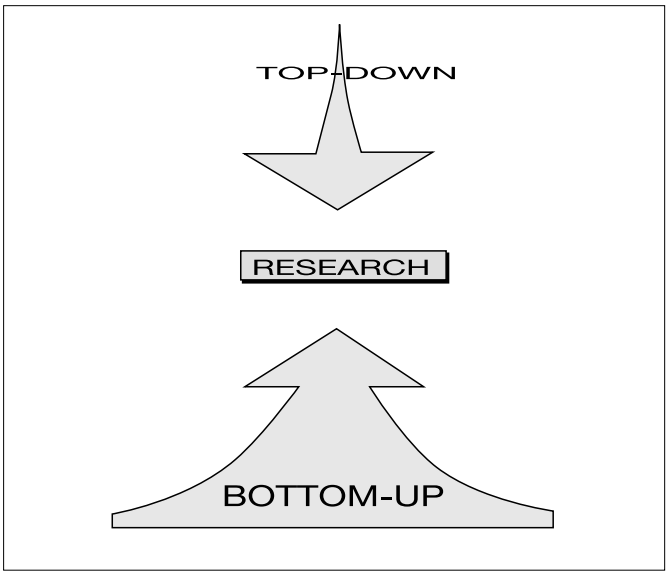
Satisfaction of one´s curiosity
is one of the greatest sources
of happiness in life.

LINUS PAULING

Obviously politicians are not here to provide merely happiness to scientists. And indeed, there are better reasons for preferentially supporting curiosity-driven research. For example, Joshua Lederberg (N.P. Medicine, 1958) said :

"You rarely find the most
important things by
deliberately looking for them".

Many examples demonstrate how accidentally most important discoveries were made which laid the foundations for extremely fruitful developments. Just to recall a few of them, I would like to mention the discovery of the genetic laws by Gregor Mendel, the finding of penicillin by Alexander Fleming, the invention of Scotch tape, and the development of the Internet.



Clearly, we scientists favor the bottom-up approach in science, were the researcher selects the most promising research project. We are convinced that the top-down approach with research directives formulated by the political authorities are much less effective. It is apparent from the figure above how fragile the top-down approach can be. The thin thread may break quite easily, leading to a smaller or larger disaster for the science community. The bottom-up approach, on the other hand, is stable and self-correcting. The conclusion is:

LIBERATE SCIENCE FROM
ALL EXTERNAL CONSTRAINTS !!

But whenever freedom is provided, it implies also responsibility. Freedom means to do voluntarily what needs to be done. In the words of George Bernhard Shaw:

"Liberty means responsibility.
That is why most men dread it".

GEORGE BERNHARD SHAW (1856-1950)

Responsibility implies that scientists select research projects that can be shown to be relevant, and have a desirable goal that can be publicly defended. Even the most basic research projects should have at least a long-term beneficial effect. Doing research just to be first, is in my opinion not a sufficient motivation for a project to be supported by public funds. Research projects must make sense. Obviously, the relevance of research has to be interpreted in a very generous and long-term manner. Also fundamental basic research may have relevance, perhaps not today, but in the near or father future.

Education

Research is essential but teaching might be even more fundamental. Each research project has inherently a learning and teaching aspect: The active scientist learns and obtains insight by doing experiments, and spreading the news by publication and giving lectures represents a true teaching activity. It has been said by James J. Duderstadt:

"There is a growing recognition that few public investments have higher economic payoff than those made in higher education".

JAMES J. DUDERSTADT (1999)
Former president of University of Michigan

As a scientist, one might feel that education is what we are being paid for, and research is what we enjoy. But true satisfaction can be reached only by a combination of both activities. The education and motivation of young brilliant scientists is perhaps the most rewarding task of a university professor.

But education at the universities is very often not as efficient as it could be: Large classes sitting or sleeping through rather boring lecture courses and little personal interaction with the teachers! I was educated at the same school as Albert Einstein, and he seems to have made similar discouraging experiences at the famous Swiss Federal Institute of Technology in Zurich:

> *"It is nothing sort of a miracle that the modern methods of instruction have not yet entirely strangled the holy curiosity of enquiry".*
>
> ALBERT EINSTEIN

Having to sit for 20 years in a school bench, just filling the head with knowledge, disconnected from reality, is hardly the proper way for inducing motivation. However, motivation is the most important prerequisite for efficient learning. How much easier is it to learn on a subject in which one is truly interested!

Motivation !

Sooner or later, we should abandon our antiquated classroom-lecturing. Learning does not happen while watching the performance of a lecturer, it has to be done individually. Lecture courses are primarily suited for providing a survey on a field of science, to give directions of studies, and to motivate students for their individual learning.

Today, there are exciting novel possibilities arising for personalized learning using computers and the Internet. We should efficiently integrate these modern methods of learning into our university teaching, following the implicite advice of David P. Gardner.

> *"There is a disconnect between students who come to the universities steeped in technological, electronic, and other visually based methods of learning and a university pedagogy that is rooted more in the past than planted in the future".*
>
> DAVID P. GARDNER
> Former President of the University of California (1999)

The students are ready, but the teachers might be reluctant. Of course it takes less effort to prepare a classroom lecture and to present it without changes during the next thirty years than to design an interactive teaching course. But I am sure that changes have to occur in this domain in the direction Peter Drucker has in mind when he sais:

> *"Thirty years from now the big University campuses will be relicts. Universities won´t survive. It´s as large a change as when we first got the printed book".*
>
> PETER F. DRUCKER (1997)

I do not think that University campuses will disappear. But the new technologies will become of great importance, complementing the indispensable personal contacts between teacher and student.

Public Education

I am convinced that the teaching obligation of universities does not end at their doors. It is not sufficient to educate specialists, but the scientific knowledge has to be brought into our society. A basic scientific understanding is indispensable for proper behavior in our sophisticated technological world. A possible communication gap between science and society might lead to a disastrous future of humankind.

Sometimes, I imagine our society as being on a "vol de nuit", a night flight, having lost ground and guidance, not knowing in which direction to fly. Sooner or later a crash landing seems to be inevitable. Our teaching obligations indeed, go much beyond the university walls. They do not even end at the frontiers of our country nor of our continent but encompass the entire globe. You know, we scientists are regularly flying back and forth between Europe and the United States, touching a rather small part of the globe. But we know very little about the "unknown majority", where the real problems are awaiting us.

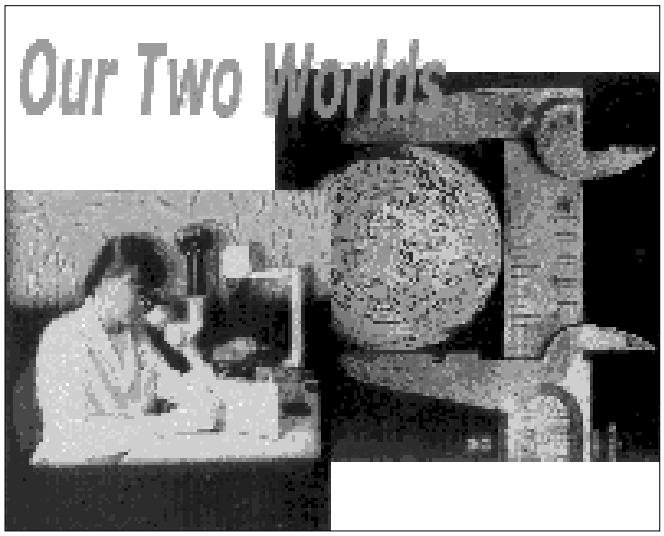
Let us take, as an example, Uttar Pradesh, with its 140 million inhabitants: 86 % of the women and 61 % of the men are illiterate, adding up to more than 100 millions of illiterates in just a single state of India! Most likely, it is true what Paul M. Kennedy said: "Our global society is in a race between education and catastrophe."

Many options are available for complying with our educational obligations towards society: Public lectures, adult education classes, popular publications, radio and TV broadcasts, political activities, and certainly personal contacts. Whatever we invest in terms of public education in our own country and abroad will be beneficial for the future of humankind.

In this context, it becomes obvious that it is insufficient to provide our students with a sound training as scientific specialists. They should at the same time be put into a position to act as scientific ambassadors who can spread the scientific knowledge among a broad population. Universities are not supposed to be treasurers of knowledge but sources of inspiration and promoters of beneficial developments.

Conceptual contributions by science

But do we scientists really have to say anything of public relevance in our public appearances? Are we properly prepared for our global leadership role? All too often, I get the impression that we scientists are no longer a true elite, capable of guiding society. We became skillful super-technicians, but we have lost the wisdom and the foresight needed to conceive and articulate guidelines for the global development.



There are indeed two disjoint worlds: the exciting small world seen through our microscopes, and on the other side the enormously large, but still finite macroscopic world squeezed by advanced technology, consuming energy and raw materials. Of course, scientific details are of great technological importance, and the problems of the macro world can not be solved without further progress on the microscopic scale. But we have indeed to reflect upon the relevant words expressed by Frank H.T. Rhodes:

> *The sciences have become powerful, but increasingly unintelligible to nonscientists.*
>
> *The social sciences, entranced by microanalysis and quantification, have become increasingly irrelevant to social issues and public policy.*
>
> *The humanities, embracing fragmentation, otherness, and unreality, have neglected the great overarching issues of human commonality".*
>
> FRANK H.T. RHODES (1999)
> Former President of Cornell University

Often, we scientists have lost contact with reality and are more than happy when we can pursue our studies unperturbed by the public.

On the other hand, society develops today in a world bare of idealistic concepts. True, attempts are being made to save some of our rather antiquated institutional heritage. For example the catholic clergy tries with all means to regain its past glorious power. A deterrent example is the unfortunate, very recent <Declaration "Dominus Iesus" on the Unicity and Salvific Universality of Jesus Christ and the Church>, with painful sentences, such as

> 17. Therefore, there exists a single Church of Christ, which subsists in the Catholic Church, ... On the other hand, the eclesial communities which have not preserved the valid Episcopate ... are not Churches in the proper sense;....
>
> 21. ...Furthermore, it can not be overlooked that other rituals, insofar as they depend on superstitions or other errors constitute an obstacle to salvation.

Reading this document, signed by Cardinal Ratzinger, one cannot escape the feeling of being set back into the dark middle ages. But what are otherwise the (pseudo-)ethical foundations of our modern way of life?

It seems indeed that this well dressed monkey, became our generally accepted role model: Free market economy and big business are what count and determine nearly all of our actions. The concept of maximizing profits and maximizing shareholder value is prevailing. We all became passionate stock market gamblers. Our pension plans depend on the expected gains. There is hardly any ethics, moral, or global responsibility left.

The competition with the enormously successful United States is driving and stimulating the European business. No question, we are running behind the United States: The Euro is dropping, the Dollar is strong. The European stock market is shaky and unstable. European business is reasonable but certainly not as superb as in the United States. We have to run faster in order to catch up. But nobody is asking the crucial question:

"Are we all running in the proper direction?"

Some aspects of the United States are truely remarkable and admirable: The country is politically stable and economically healthy. The best universities worldwide are in the United States. The unceasing creativity and productivity seem to justify the American way of life. But even the United States have inherent problems. There is a growing gap between the country´s rich and the poor, and an ominous growth of the lower class. This is not true only for the United States, that is an unfortunate fact of the entire globe. The erosion of our sense of community and civil life, the nation´s troubled system of public schools, the disquietude within the body politic, attributable to the problems mentioned and to in-migration reshaping the ethnic balance are serious problems that might disturb the existing apparent social equilibrium.

It seems that we are living today on the account of the disfavored, on the account of third world, and on the account of the future generations. We are exploiting the natural resources, and not much will be left in 10 or 100 years. Free market economy is based essentially on Charles Darwin's principle of competitive evolution. The system is governed by an intricate system of feedback loops, and it corrects itself whenever it tends to deviate from an optimal path.

Charles Darwin's
Competitive Evolution

was beneficial for	but might not be optimal for
NATURE	ECONOMICS

Darvin's competitive evolutionary concept of natural selection was enormously beneficial for nature. Otherwise we would not be here as an advanced race. But it was also sometimes extremely cruel. Just put yourself into the skin of a dinosaur, and you will understand what I am speaking about. I do not think we can afford to be as cruel in economics as nature has been in its long-term evolution. It is after all against any ethical concept and against human charity. Some additional control mechanism seems to be inevitable.

A free market system without external control does also not preserve nature. The response time of nature, being tortured by the excesses of our civilization, is much to long to allow for an efficient control mechanism. The profits made on the account of nature are happily spent long before the adverse reactions of nature become obvious. A feedback system can not work in a system with strong irreversible character where corrections of severe damages are no longer feasible. When the natural resources are gone, they are gone forever, even if the atoms remain.

www.globalissues.org/envissues/globalwarming.asp

This comic strip illustrates the kind of attitude prevailing today.

When the economical system can no longer control itself, we have to build in heavy penalties in order to enforce a development that takes into account generally accepted principles of sustainability.

But who will provide these penalties? Who will initiate radical changes in our economical system? - Industry? - I do not think so. Just imagine a manager in a company who is forced to take advantage of all loop holes, which he can find in the legal system, in order to maximize the profits and the share holder value. Otherwise he would loose his job. There are also plenty of lawyers ready to help when a managing team has once crossed the lines towards illegality, but nobody will help when it behaved too responsibly and thereby lost chances of profits. Job safety in industry is low today, and industrial managers are not in a position to change the direction significantly towards more ethical behavior.

What about politics? Politicians are in a similar position. Their primary goal is to survive personally and to solve daily problems of public appeal in order to collect precious votes. Frequently, the public has good reasons to distrust politicians, and honesty seems not to be a virtue that promises political success, at least not on a short time scale. Indeed, politicians are often not positive examples regarding ethical behavior. 'Why should we, small ants, behave, when the elephants go wild and destroy moral and climate?'

The worst pollution of the environment is the one on moral grounds!

The question remains: Who will provide the indispensable foresight needed for a prosperous and sustainable future development of humankind? I am convinced that the universities and the academic community have to carry a major share of responsibility in this regard.. University professors are sitting on rather solid chairs. Even if they express unpopular truths, their position can not be put into question. In fact, they are paid by society to provide guidance, not only by working out more scientific details, but by articulating foresight and critics of shortsighted public behavior. Indeed, I consider it as one of our foremost tasks to convert universities again into creativity centers for societal renewal!

Contributing lasting societal concepts requires intense interaction between the various disciplines, between the sciences, humanities and liberal arts, in the sense brilliantly expressed by the former president of Cornell University, Frank H.T. Rhodes (1999):

> *"In an era of broken families, dwindling religious congregations, decaying communities, our nation(s) desperately need(s) a new model of community –knowledgeable but compassionate, critical but concerned, skeptical but affirming– that will serve the clamoring needs of our fragmented society and respond to the nobler, unuttered aspirations of our deeper selves. This emerging community will be the New University".*

I hope that we will, after all, be capable of replacing the present-day "free market economy" by a future "responsible market economy" that takes into account the needs of our entire globe in view of a sustainable future development.

I am not in a position to suggest simple recipes. Only in an intense collaborative effort of everybody we can find lasting solutions. We should not expect rapid and simple solutions of the problems accumulated during the past two or three centuries. But it is very urgent to start to devote our efforts towards this goal. We have to break barriers, barriers between the scientific disciplines, between the sciences, the humanities, and liberal arts, between science and the public, and between science and the commerce. Everybody's contribution is needed, as expressed by Jacob Nüesch (1999), the former president of ETH-Zürich:

> *"By integrating natural sciences, technology, the humanities and the social sciences, we can devise innovative concepts of education and research, that will allow us to tackle the enormous challenges facing humankind".*

Our foremost task is to devise a new kind of globally accepted ethics, an ethics that combines scientific reasoning and knowledge with human respect, compassion, and culture. We need a renewed foundation on which we can base our future actions. We have to supplement the humanistic aspects we are missing in the system of free market economy.

Obviously, it is unnecessary to reinvent ethics from scratch. All the relevant principles have been formulated over and over again in the context of the great world religions. But the latter are losing more and more their previous importance. Finding a novel universal framework of old, well-proven concepts from our great human heritage might be what is needed.

There is a great need for effective supranational structures. Most of the problems to be solved today have an international character. Environmental aspects are global. Our remaining resources are global property. Communication and traffic are nearly without limits. And also the major commercial companies are truly international. Only the political authorities operate within narrow national limits and are no longer capable of exerting their responsibility.

Science has a true international character, and our contacts as scientists have no nationalistic limits. It appears natural that the academic community can efficiently promote international collaboration in those domains that are essential for the survival of humankind.

Our universities have to be restructured internally in order to master the additional tasks demanded from them. Here is a short list of possible short-term actions for improving the present too much fragmented organization of the universities:

- Appoint professors with a broad scope and a critical sense for global accountability, obviously without jeopardizing their top scientific qualification.
- Stimulate the formation of interdisciplinary discussion groups (think tanks) involving staff members and students.
- Organize seminar weeks at a secluded place on ethical, societal, and long-range development prospects.
- Discuss regularly in group seminars the general context and relevance of the own work as well as societal questions.
- Invite 'experienced field workers' and 'profound thinkers' to institute seminars.
- Organize pair lectures together with a lecturer from the humanities.
- Invite to your lecture courses a representative from the humanities for occasional comments.
- Invite a representative from the humanities to (PhD)-examinations for general questioning.
- Present all lectures such that even a layperson can grasp the meaningfulness and relevance of the topic without having to understand the details.
- Acquire the skill to fascinate also non-experts of various shades.
- Even the most highly rated journals should allow for editorials on general aspects of science and society.

After all, we should be reminded that we are not first ones in history being faced with such fundamental problems, as David Gardener recognizes when he says:

> *"We should be reminded that others before us in the Western world, from the twelfth century on, somehow essentially managed in the face of complacency, indifference, ignorance, and despair to raise the university´s lamp high enough to illuminate not only the university´s future but also its link to a more broadly civilized and cultured society."*

Although I have expressed some qualification of the merit of research following exclusively its own inherent rules, imposed by our responsibility towards society and the globe, I subscribe to the following statement of the science advisor of Bill Clinton, Neal Lane, made at the beginning of this year:

"Science and technology is about s good an investment as you can possibly make"

But an optimal investment requires more than science and technology in splendid isolation. Perhaps the most essential foundation for the ultimate success of science was expressed already 500 years ago by François Rabelais:

Science sans conscience n'est que ruine de l'âme.

François Rabelais (1494-1553)

Science without conscience is the ruin of the soul.

I do not have to add anything to this eternal truth. Let us keep it in mind when we go back to our beloved laboratories.