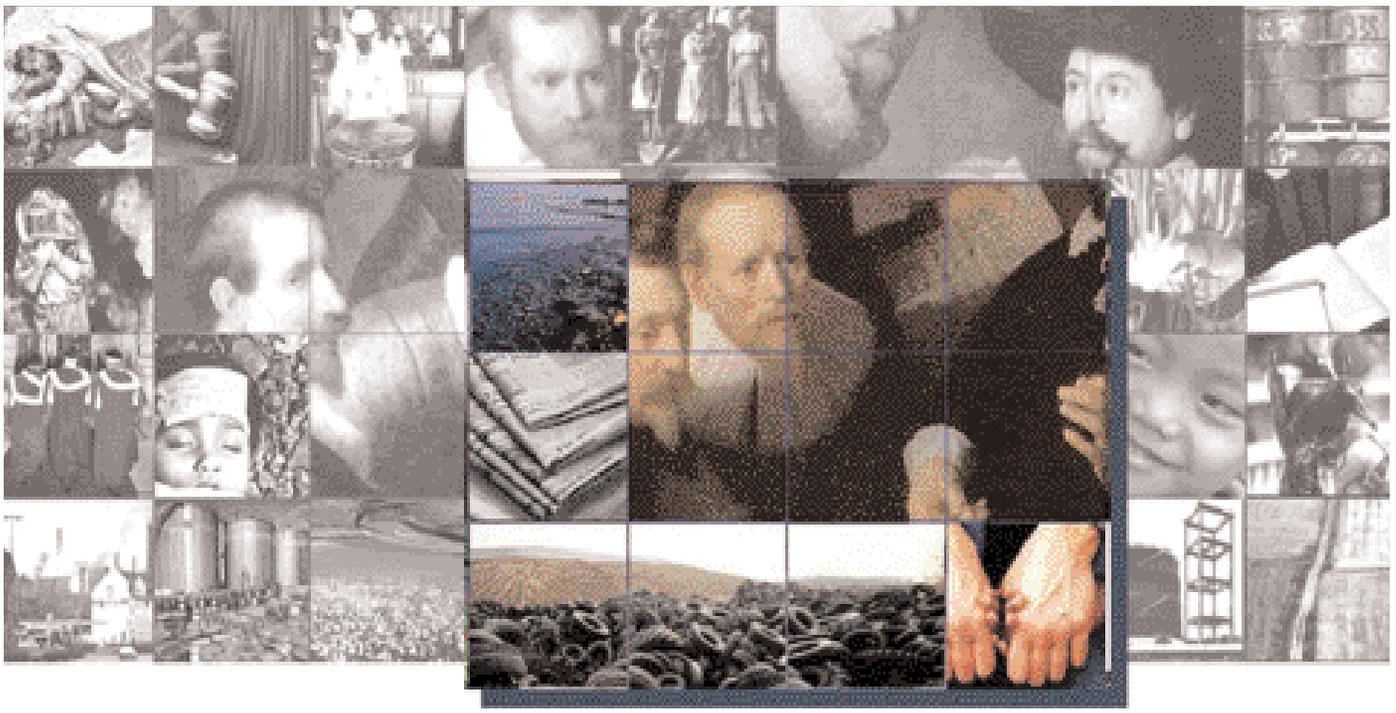
*Hartmut Frank*
*Chair of Environmental Chemistry and Ecotoxicology*
*University of Bayreuth (Germany)*
*encetox@uni-bayreuth.de*

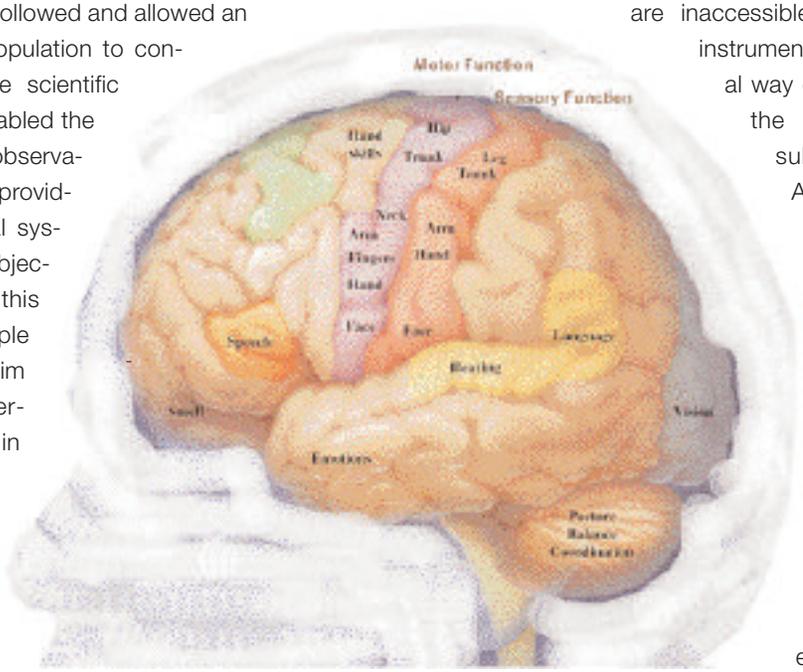


# EDUCATION FOR THE HUMAN ENVIRONMENT

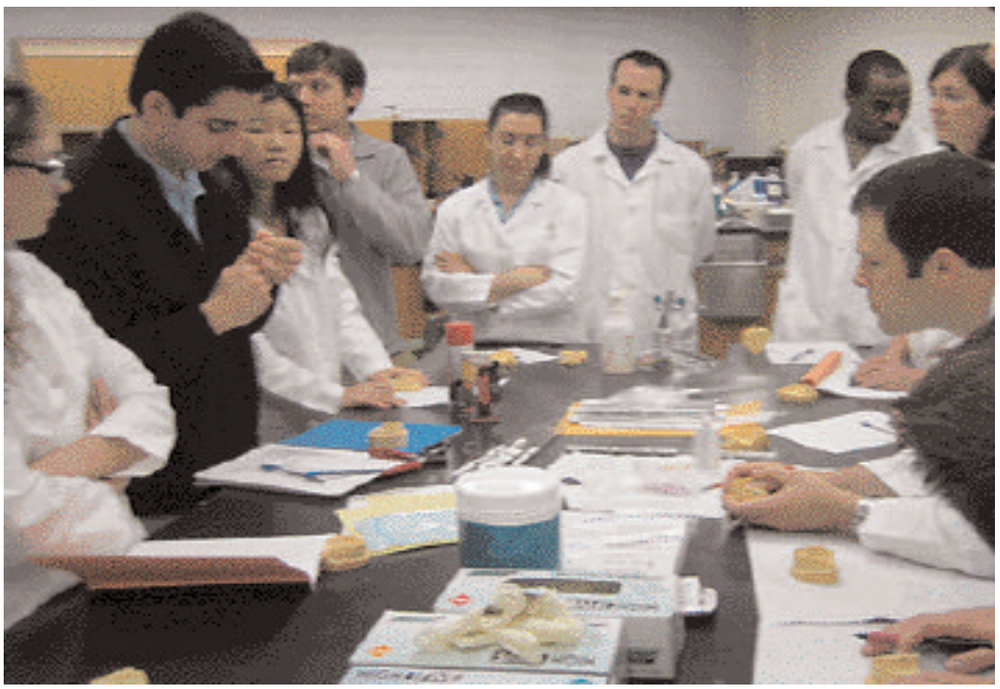
**Knowledge models describing man and nature as a scientific complex machine** but perfectly controlled have clear limits. It is necessary to develop new cognitive and formative models for an environment at human scale.

During the last century, the citizens of the industrialized countries have enjoyed continuously increasing life expectancy as a result of the availability of sufficient quantities of high-quality foods and pure water, the relief from hard work by automated mass production of goods, and the discovery of new therapeutic drugs, materials, instruments and techniques for medical diagnosis and treatment. This was possible due to tremendous advances in science and technology, nonetheless in chemistry. Inventions of new chemicals of great usefulness such as agrochemicals, pharmaceuticals, polymers, or ceramics, and the design of efficient ways to make them, their application in all sectors of daily life, from textile industry to agriculture, from making cars and electronic devices, to the health care systems, all this has greatly contributed to the comparative well-being of men and women in the industrialized countries. All this contributed to fulfillment of the basic needs of life, lowered infant mortality and allowed more time for cultural and artistic development, a great advancement over former times when most human beings were occupied most of their active lifetime for securing food and shelter. The basis of all this was, on one hand, the abundant availability of cheap raw materials and energy from fossil fuels, and on the other hand of the capability of the citizens in efficiently co-operating under the respective educational, economic and socio-political conditions in converting raw materials with the use of energy into products if great usefulness.

As a whole, the historical development of science meant to a more detailed understanding of the physical and chemical principles of the world and of nature. In former times, only a few - monks, artists, the nobility, the ruling classes - enjoyed the freedom of being able to follow the inner longing to know "Who am I in respect to the whole of nature?", the most noble motif for scientific research. With the scientific-technical advances, continuous and increasingly faster growth in industrial output and individual consumption followed and allowed an increasing fraction of the population to contemplate this question. The scientific way of analytical thinking enabled the conversion of experimental observations into practical solutions provided by the modern industrial system. The approach of the subjective scepticism made all this possible, i.e. that in principle man and the world around him can be completely understood, objectively measured in all its cause-effect relationships. All these advances contributed by the modern scientific-technical system are based upon the Cartesian principle of: *Cogito ergo sum.*




This very successful philosophy of "I exist because I think", focused the human mind onto the materialistic aspect of our realities and led to today's belief that the whole world, the human being, his environment at large, in fact all of nature are wholly and completely understandable in a rational-intellectual approach and, in principle, fully and completely predictable. This viewpoint, this theorem - successful in establishing the modern scientific-technical-industrial system - resulted also in a kind of narcissistic view of man being the ultimate measure, claimed objectivity of man's view and ways of cognition, and entailed the concept that the human being in itself - as all other living beings - is nothing else than a biochemical reaction box, albeit very complicated. The great practical effectiveness of the Cartesian Theorem led to the belief that this methodology is of absolute nature. The astonishing self-limitation in the ways of cognition, however, prevents man from fully understanding himself and his context and his environment at large. It is obvious that our physical and chemical means of viewing nature are limited by our senses and our conventions, by the narrow range of visibility of the electromagnetic spectrum over a short wavelength range of a few hundred nanometres; if we want to expand this range a little we need to design complicated instruments. Logically, one can only design instruments for such phenomena of which one has some sign of existence; all other non-chartered areas of cognition, all other aspects of the world around us are inaccessible to our senses, to our instruments, even to our conventional way of thinking, as for instance the particle-wave dualism of sub-atomic matter shows. Although this is a simple, obvious truth, it is surprising to realise that we still tend to believe that all which is non-measurable and non-thinkable in our standard approach is non-existent. This in spite of the fact that the limits of this approach are becoming visible at all layers of life, as well as in science proper: since Heisenberg's discovery of the uncertainty principle it is known that the observer influences the outcome of an experiment. We behave like fish in water who declare that, after having traveled all the oceans and rivers, the world is nothing else than a tortuous fluidic compartment confined by fuzzy, muddy walls. Another concrete "scientific" example: although it is known that Gregor Mendel's experiments "proving" the laws of inheritance could afterwards never again be repeated to such clear-cut results as he reported, the deduced laws of inheritance, together with Darwin's observations on the Galapagos finches and its extrapolations, are still maintained as irrefutable proof of the absolute "truth" of the derived "laws". Either Gregor Mendel cheated in order to be able to maintain his preconceived working hypothesis, or he, unknowingly and unconsciously, influenced the results of his experiments in order to find the "right" results. Many such examples are known in science (W. Broad, N. Wade, Betrayers of the Truth, New York, 1983), and still the absolute "objectivity" of scientific findings is rarely ques-



tioned. Obviously, the traditional scientific-technical approach has its limits, internally and externally, especially in the biological sciences, for instance in medicine. It is known today that psychological conditions can have great somatic effects on well-being or sickness. A typical example is the so-called placebo-effect but it is hard to conceive of a corresponding "placebo-biochemistry" in our standard-scientific approach. Or what is the "biochemistry of instinct"? Many other examples come to mind, for instance the fact that men, men and animals, or even animals between themselves can communicate on levels which are so far inaccessible by traditional scientific approaches (e.g. Rupert Sheldrake: The Sense of Being Stared at: And Other Unexplained Powers of the Human Mind). It seems that living organisms have also a concrete metaphysical reality, besides their material aspect. Although all this evidence is accumulating, modern science continues to neglect this dichotomy. The consequence is dramatic; since humans and nature are predominantly conceived as machines, they have sometimes thought of as such: raw materials and spare parts which are to be managed and in principle replaceable. In the European historical past, the Christian religion with its moral standards has at least for some time maintained ethical barriers against such instrumentalisation of the human being and of nature, but with the secularization and isolation of spirituality from daily life, this bastion fell. However, the process of secularization was necessary as religious doctrines and the respective administrative bodies too often have lent themselves as a means for justification of injustice and power execution.

Evidence is accumulating that the traditional scientific methodology based upon the subjective skepticism is approaching its limits, both internally as well as externally. The Cartesian methodology is becoming less efficient, it leads to increasing over-exploitation of the natural resources and limits scientific cognition. The economic growth entails the depletion of natural resources, and the dwindling of resources must be compensated and paid for by an increasing fraction of poor populations and by the exploitation of the resources of less industrialised countries which cannot utilize them because of little political stability and insufficient educational, social and economic infrastructure. At the same time, in the industrialised countries increasing marginalisation of weaker groups of society and cutbacks of the welfare systems are becoming visible. For instance, the traditional academic education systems, now "streamlined" by the so-called Bologna Process, are substituted in spite of the fact that the former educational systems of most industrialised countries have functioned well.

It is clearly an attempt to make ends meet between the needs of society of investing into the education of well-trained specialists and the increasing difficulties in financing it. Academic education and research is presently mainly directed to make the training of technical experts equally efficient as before but at lower cost: the economic surplus of industry in the form of taxes and public services is declining, causing household deficits in most countries. This occurs in spite of continuously increasing production - and consumption - of material goods, in spite of continuously faster exploitation of resources, and in spite of a continuously declining quality and diversity of the global environment. While in the most advanced countries the environmental situation may have improved over the last two decades in some obvious sectors such as urban air or water quality, in the poor, weaker countries this is compensated at the expense of declin-

ing environmental quality and the compression of ecological niches of natural ecosystems such as the tropical forests. Depletion of critical resources such as crude oil or copper and a resulting shortage of critical raw materials is looming. Certainly, such developments are not individual criminal acts (sometimes they are) but are a "natural" consequence of the scientific-technical-industrial system with its innate need of economic growth - instead of equilibrium economies. There have been warnings of such a process already decades ago by the Club of Rome or by Greenpeace, just to name a few; but the dangers are now becoming concrete and pressing (e.g. Donella H. Meadows et al., Limits to Growth, The 30-Year Update).

The principal question is: Why have all the reasonable demands for change remained unheeded, in spite of the fact that the global industrial system is approaching its limits of growth? It is a consequence of the fact that the corresponding socio-political systems have shaped all the educational structures, from children's rearing in their families to adolescent's professional training; all this has continuously been adapted to fit to the industrial-economic machinery. The primary principle of formalised education of today is to prepare an adolescent for being knowledgeable in his chosen professional subject, for being successful in the competition for the corresponding jobs, and for being able to secure his/her access to material wealth during adulthood.

In itself this is an important and necessary preparation for the ability to maintain a reasonable standard of life. But the one-sidedness of education regards insufficiently all the other aspect of the human reality, his/her emotional, spiritual-metaphysical and social-affectionate capabilities and needs. These latter aspects are largely disregarded, leaving a great void. The spiritual education is largely left to a fortuitous process dominated by families, churches, peers, political parties, economic interest groups, etc. Thus, as there is a great need felt by almost all human beings to address this other aspect; the present growth of all kinds of esoteric movements as a result for this longing for filling the widely felt void of spirituality is no surprise. Extension, widening and integration of the scientific and cultural scope is necessary.

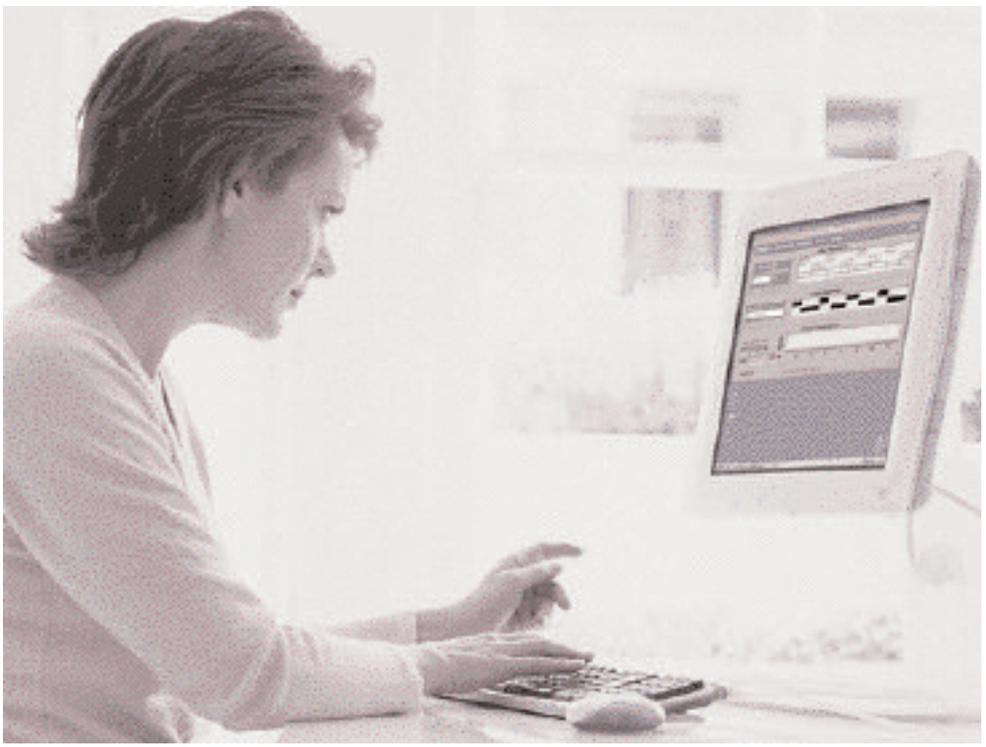
The growing appearance and influence of new religious groups and movements, the search for esoteric or metaphysical answers, and the disorientation of large sections of the world's societies shows that the full secularisation of life has led to a growing want for a complete understanding of men's life and the world around him/her. These parameters strongly influence men's well-being, from social structures to individual situations.

It is obvious that the purely scientific-technical educational approaches are not enough to reach a full understanding of the human situation.

In this context, the traditional education structures must be re-adjusted, to cope with these foreseeable challenges. New programmes and patterns of training are needed which allow the young generation to reach a more comprehensive view of man and nature, without dogmatic barriers or conceptual taboos, to train new professionals with a view of responsibility and affection for the human being and nature, rather than the present specialists with their fragmented understanding. The new scientific professionals should be able, on one hand, to understand the particular scientific-technical details of his/her professional subject and, at the same time, to judge the economic, socio-psychological, ethical, and spiritual connotation of his/her activities, integrating his/her physical and metaphysical reality. In other words, he/she, the new scientist, must be trained to open his/her mind to the fact that the scientific approach with its positivistic/materialistic views entails a certain blindness for the fact of the existence of a metaphysical reality of man and nature - of its real existence, not only as an intellectual concept.

When the tremendous achievements contributed by science in creating highly efficient technologies in the last century were linked and integrated with cultural, spiritual and metaphysical aspects, the future could open new possibilities. The efficiency of the scientific-technical-industrial complex has, to a great deal, liberated men from time-consuming, laborious practices of old times. Instead of wasting this efficiency gain in unemployment, boredom, and the escape into consumerism, it should be utilised to extend the training of students and young scientists, in order to confer to them the knowledge and affection needed to actively create environments which are better suited to fulfill all the needs of men - and nature - including his/her/its ignored metaphysical reality. Or in other words, to make the human - and nature's - needs and realities a central decision-making principle, rather than subjecting the human individual and society to the self-driving and self-driven blind industrial machinery which is becoming more uncontrolled and uncontrollable. In principle, this does not mean that the present academic systems must be given up, but must be restructured and enlarged by complementary elements in which, for instance, students of a discipline in the classical sciences are also educated in fields presently considered as metaphysical, taking the cultural and spiritual realities of the surrounding ecological and social system, the communities and environment in which they live and work, into consideration. Thus, they will be able to develop a

better understanding of responsibility for and between individuals and their environment - and vice versa. The main task is to bridge the gap between ethics and science, suggested already 50 years ago by C.P. Snow, or more recently by some economic theoreticians (e.g. Leo Nefiodow, Der sechste Kondratieff (The Sixth Kondratieff), Rhein-Sieg Publishers 2006).



When considering the realities and potential of the present European, even global, integration process and the new information technologies (Internet, e-mail), there is a great potential in achieving the goal of extending education to make it more complete. New ways must be developed to expand the scientific-intellectual education of pupils and students, to bridge the gap between these two aspects of life and nature. Studying and recognising the material and metaphysical aspects and consequences of advances in science, culture and ethics at the same time by integration of both faces of the same coin, will allow qualitatively deeper insights and the development of synergies; these are needed in order to cope with the apparent global limits in growth. At the same time, attempts should be made to design educational structures in such way that the individual capability of each student is fostered to his/her greatest potential, instead of shaping students into the Prokrustes-bed of rigid curricula. Even the structure of interaction between teachers and students need to be scrutinised; complementary to the standard hierarchic teaching model, a circular, interactive process of elucidating a given problem should be tested, an approach as for instance suggested by some sociologists (e.g. Peter C. Dienel, Die Planungszelle (The Planning Cell), Westdeutscher Verlag, 2002).

It is clear that bridging the gap between these two realities is a fundamental need. As there are practically no models how to do this, it must be attempted experimentally. As an example, any relevant environmental-scientific issue could be studied, together with its economic, cultural, socio-psychological and ethical implications. This can be the project of groups with different scientific and intellectual background and expertise, for instance in judging the environmental impact of chemicals, regarding the economic and social consequences of their production and use, and to assess the cultural and ethical implications - so-to-say a complete eco-efficiency and eco-quality study. Other subjects of environmental relevance are also conceivable. Such projects would not only open the understanding of the cultural impact of scientific-technical advances to students in science, but also, vice versa, would make the importance of technical developments for cultural and intellectual developments more transparent for students of the humanities. There is a great practical need for such a comprehensive, holistic approach under the present conditions of globalisation of science, economy, and ecology. Starting to build such bridges from a concrete, scientific foundation under expansion towards its cultural, ethical and spiritual counterpart may perhaps seem courageous, but in view of the present precarious global situation it should be attempted.


RIASSUNTO

***Educazione per l'ambiente umano***

*I modelli di conoscenza che descrivono l'uomo e la natura come una macchina scientificamente complessa ma perfettamente dominabile presentano evidenti limiti. È necessario sviluppare nuovi modelli cognitivi e formativi per un ambiente a misura d'uomo.*