iap

the
INTERACADEMY PANEL
on international issues

a global network of science academies

Statements

15th Anniversary

1993 | 2008

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iap is a global network of the world's science academies launched in 1993. Its primary goal is to help member academies work together to advise citizens and public officials on the scientific aspects of critical global issues. **iap** is particularly interested in assisting young and small academies to achieve these goals.

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IAP STATEMENTS

The InterAcademy Panel on International Issues (IAP), a global network of 98 merit-based science academies, aims to enhance the role of science academies in society. It seeks to do this by building the capacity of its member academies through the organization of workshops and conferences on critical science-based issues, the creation of regional networks of academies and the forging of partnerships with other scientific institutions that share IAP's values and vision.

A central focus of IAP's mission is to reach out to society and participate in discussions on critical global issues in which science plays a crucial role. In the 21st century, that means virtually every major issue facing society.

Since its inception in 1993, IAP has been producing joint statements on issues of fundamental importance to humanity. This is why we thought that republishing the 11 statements that IAP has issued during its brief history would be an excellent way to celebrate our 15th anniversary.

These statements are not only a reflection of the major issues that have confronted society during the past decade and a half. They are also evidence of IAP's ongoing commitment to society. Some of the statements address the most significant challenges of our times (population growth and urban development). Some deal with today's most controversial issues (therapeutic cloning and the teaching of evolution). Some focus on ways to improve the relationship between science and society (science and the media, and science education). And some concern IAP's core issues (building scientific and technological capacity, especially in developing countries, within the context of promoting sustainable economic growth).

Statements, of course, are meant to be heard, read and acted upon. We are therefore delighted to note that these 11 statements have been made available to prominent decision makers and to the media across the globe. For example, they have been presented to diplomats and public officials during international conferences and summits held by the United Nations and the G8. They have been discussed at conferences attended by national leaders. They have been the focal point of press events organized by individual academy members, and they have often been translated into several languages to increase their visibility and impact. All of this has taken place thanks in large part to cooperative efforts between the IAP secretariat in Trieste, Italy, and IAP members.

The statements, drafted by some of the world's most prominent scientists and signed by a significant majority of IAP members, seek to distinguish scientific insights from casual observations and to propose a set of action-oriented options for addressing complex challenges. They were produced in a collegial atmosphere where discussions were open and decisions were reached by consensus. All members of IAP were encouraged to participate in the drafting process, yet each member of IAP was free to sign, or to not sign, the document. IAP statutes require that two-thirds of the members agree to sign a statement before it becomes an official IAP statement.

In many ways, the process by which IAP develops its statements is just as important as the final text. Eminent minds with extensive experience are put to work analysing a difficult issue and describing possible pathways for society to move ahead. Discussions unfold in an atmosphere that encourages respectful debate and that seeks to reach a consensus upon which a majority of the participants can agree. The resulting statement, once approved, is distributed to the broadest audience possible in the hope of stirring meaningful dialogue on an issue of great importance to society.

This has proven to be a good way for IAP to prepare and disseminate member-endorsed statements on critical issues. Such a process, we believe, would also be a good way for our global society to proceed in addressing today's fundamental challenges and controversial issues. Open dialogue, expert opinion, reasoned judgement, broad dissemination of the findings, a search for common ground and possible strategies for making progress on the issue under debate are not only a reasonable way to officially prepare statements, they also offer a framework for addressing the world's most critical environmental and economic problems. It is for this reason, above all others, that we have used the occasion of IAP's 15th anniversary to reprint the 11 statements we have published over the past 15 years.

We hope the booklet will provide not just a glimpse of what IAP has done in the past but, in a modest way, also suggest a framework for the discussion of the critical issues that will face society in the years ahead.

IAP Co-Chairs

Chen Zhu

Minister of Health
Beijing, China

Howard Alper

Chair, Government of Canada's Science, Technology, and Innovation Council
Distinguished University Professor, University of Ottawa
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Copies of the statements may be downloaded from the IAP website at www.interacademies.net.

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iap statement on

Population Growth

1994

Population Summit of the
World's Scientific Academies
New Delhi, India, 24 – 27 October 1993

Let 1994 be remembered as the year when the people of the world decided to act together for the benefit of future generations.

The Academies of the world call upon the governments and international decision-makers, especially those at the 1994 UN International Conference on Population and Development, to take incisive action now and adopt an integrated policy on population and sustainable development on a global scale.

The Problem

The world is undergoing an unprecedented population expansion. Within the span of a single lifetime, world population has more than doubled to 5.5 billion and even the most optimistic scenarios of lower birth rates lead to a peak of 7.8 billion people in the middle of the next century. In the last decade, food production from both land and sea declined relative to world population growth.

The relationships between human population, economic development and natural environment are complex and not fully understood. Nonetheless, there is no doubt that the threat to the ecosystem is linked to population size and resource use. Increasing greenhouse gas emissions, ozone depletion and acid rain, loss of biodiversity, deforestation and loss of topsoil, shortages of water, food and fuel indicate how the natural systems are being pushed ever closer to their limits.

The developed world, containing less than a quarter of the world population, accounts for 85% of the gross world production and the majority of the mineral and fossil-fuel consumption. Both rich and poor countries add to environmental damage through industrial activity, inappropriate agricultural practices, population concentration and inadequate and inattentive environmental concern. Yet development is a legitimate expectation of less developed and transitional countries.

The Solutions

Our common goal is the improvement of the quality of life for all, both now and for succeeding generations. By this we mean social, economic and personal well-being while preserving fundamental human rights and the ability to live harmoniously in a protected environment. To deal with the social, economic and environmental problems, we must achieve zero population grown within the lifetime of our children.

These goals are achievable given time, political will, intelligent use of science and technology, and human ingenuity. But only if appropriate policy decisions are taken now to bring about the requisite social change.

How do we go about this task?

We need:

- equal opportunities for women and men in sexual, social and economic life so they can make individual choices about family size;
- universal access to convenient family planning and health services and a wide variety of safe and affordable contraceptive options;
- encouragement of voluntary approaches to family planning and elimination of unsafe and coercive practices;
- clean water, sanitation, broad primary health care, and education;
- appropriate governmental polices that recognize longer-term environmental responsibilities;
- more efficiency and less environmentally damaging practices in the developed world, through a new ethic that eschews wasteful consumption;
- pricing, taxing and regulatory policies that take into account environmental costs, thereby influencing consumption behavior;
- the industrialized world to assist the developing world in combating global and local environmental problems;
- promotion of the concept of "technology for environment";
- incorporation by governments of environmental goals in legislation, economic planning, priority setting and incentives for organizations and individuals to operate in environmentally benign ways;
- collective action by all countries.

Natural and social scientists, engineers and health professionals have their part to play in developing better understanding of the problems, options and solutions, especially regarding:

- cultural, social, economic, religious, educational, and political factors affecting reproductive behavior, family size and family planning;
- impediments to human development, especially social inequalities, ethnic, class and gender biases;
- global and local environmental change, its causes (social, industrial, demographic and political) and policies for its mitigation;
- improving education and human resource development, with special attention to women;
- family planning programs, new contraceptive options and primary health care;
- transitions to less energy- and material-consumptive economies;
- building indigenous capacity in developing countries in the natural sciences, engineering, medicine, social sciences, management and interdisciplinary studies;
- technologies and strategies for sustainable development;
- networks, treaties, and conventions that protect the global commons;
- world-wide exchanges of scientists in education, training, and research.

Academy of Sciences of Albania | Australian Academy of Science | Austrian Academy of Sciences | Bangladesh Academy of Sciences | Academy of Sciences of Belarus | National Academy of Sciences of Bolivia | Brazilian Academy of Sciences | Bulgarian Academy of Sciences | Royal Society of Canada | Caribbean Academy of Sciences | Chinese Academy of Sciences | Columbian Academy of Exact, Physical, and Natural Sciences | Croatian Academy of Sciences and Arts | Cuban Academy of Sciences | Academy of Sciences of the Czech Republic | Royal Danish Academy of Sciences and Letters | Academy of Scientific Research and Technology, Egypt | Estonian Academy of Sciences | Federation of Asian Scientific Academies and Societies | Delegation of the Finnish Academies of Science and Letters | French Academy of Sciences | Conference of the German Academies of Sciences | Ghana Academy of Arts and Sciences | Academy of Athens, Greece | Hungarian Academy of Sciences | Indian National Science Academy | Iranian Academy of Sciences | Israel Academy of Sciences and Humanities | Royal Scientific Society, Jordan | Kazakhstan National Academy of Sciences | Kenya National Academy of Sciences | National Academy of Sciences, Republic of Korea | Latvian Academy of Sciences | Lithuanian Academy of Sciences | Macedonian Academy of Sciences and Arts | Malaysian Scientific Association | National Academy of Sciences, Mexico | Academy of Sciences of Moldova | Mongolian Academy of Sciences | Academy of the Kingdom of Morocco | Royal Nepal Academy of Science and Technology | Royal Netherlands Academy of Arts and Sciences | Nigerian Academy of Science | Norwegian Academy of Science and Letters | Pakistan Academy of Sciences | National Academy of Science and Technology, Philippines | Polish Academy of Sciences | Romanian Academy of Sciences | Russian Academy of Sciences | Slovenian Academy of Sciences and Arts | Royal Swedish Academy of Sciences | Conference of the Swiss Scientific Academies | Third World Academy of Sciences | Uganda National Academy of Science and Technology | Ukrainian Academy of Sciences | Royal Society of London | National Academy of Sciences of the United States of America | National Academy of Physics, Mathematics, and Natural Sciences of Venezuela

Science and Technology and the Future of Cities

1996

The challenges of an urban world

During the next century more than half of the world's inhabitants will reside in cities. The rapid growth and urbanization of the world's population are the result of many complex economic, social, demographic, and political factors and pose unprecedented challenges to the functioning of human settlements and the quality of life for their inhabitants.

Urbanization has many beneficial aspects. Cities play an increasingly vital role in education, culture, and productivity. The process of urbanization is also a significant factor in the worldwide demographic transition to lower birth rates.

Cities throughout the world, however, suffer from a host of problems, including congestion, pollution of air and water, inadequate water supplies, wasteful use of energy, problems of waste disposal, inadequate housing, the spread of communicable diseases, and the deterioration of social support systems. Many cities have expanded into areas prone to earthquakes, floods, and other natural disasters. Even those cities which are no longer growing in population continue to expand in territory, dwelling space, transportation density, resource consumption, and production of wastes.

The problems of our cities must be addressed by effective economic and social policies and strategies. Science and technology also have a crucial role and responsibility in providing solutions and in ensuring the long-term sustainability of cities and the ecosystems on which they depend. A critical factor in the ability of science to contribute to solutions will be the education, training, and capacity building of local scientific and technical expertise.

Potential of science and technology for urban development and sustainability

Advances in science and technology - especially progress in transportation, communication systems, public health, and agricultural and industrial production - have significantly contributed to the evolution of cities. In recent decades, many important new discoveries have been made in essentially all aspects of the sciences and engineering. While this wealth of new knowledge has improved the quality of life for millions of individuals, many new technological advances have only slowly penetrated to the less affluent communities of the world. In general, the potential for science and technology to ameliorate or solve the problems of the world's multiplying cities has not been realized. A much broader discussion is needed on how the range of existing technological and scientific research findings can be translated into actions at the national, regional and local levels.

As urban populations multiply, older technologies and practices - previously appropriate to settlement development - will not necessarily be the best solutions to these problems. Indeed, some once-successful technologies can lead to difficulties and become problems as the process of urbanization continues. Urban planning for the next century thus requires a fresh consideration of the current problems and available solutions within the context of regional environmental, cultural, and socioeconomic conditions.

Many new discoveries in science and engineering are potentially applicable to the amelioration of urban problems. Among these are the following:

- Computational Capability. The rapid expansion of computational power over the past two decades has permitted the construction of intricately detailed models of the behavior of the Earth's atmosphere on both global and regional scales. These models have improved steadily in recent decades and are now in worldwide use, proving better and more sophisticated understanding of the world's climate system. Comparable computational ability for modeling the micro-climatic behavior of individual buildings and building complexes also exists, but has only rarely been applied despite its obvious utility for reducing energy consumption and improving indoor air quality and the health of the inhabitants.

- Waste Disposal and Recycling. Tremendous advances have been made in waste disposal and recycling, especially of building materials and other solid waste, but are still slow in penetrating into general use globally. However, a cohesive overall plan for sustainable waste management is possible for most cities in the world. Such a plan would include techniques which ensure waste avoidance, re-use and recycling, reduction of toxic waste, proper use of incineration and landfills, and innovative biological waste management processes. The aim of such planning should be to reduce the environmentally damaging effects of the growing quantities of waste.

- Global Positioning Systems and Global Information Systems. The advances in global positioning systems (GPS) now permit entirely new methods of land management, especially when coordinated with hand-held communication systems. These are in turn part of the rapidly expanding capability of global information systems (GIS) for storage and manipulation of vast quantities of demographic, geographic and other data. These same data manipulation capabilities underlie the important development of computer-assisted and ultimately computer-controlled transport systems.

- Biotechnology and Ecological Engineering. The developments of biotechnology and ecological engineering promise changes in the design and physical structure of the human ecosystem, which will allow use of local resources in a more sustainable manner. For example, parks may serve as lungs to process vehicle emissions, and buffer zones of wetlands can prevent deterioration in coastal zones because of waste and pollutant release.

- Disease Surveillance and Control. In recent decades, improvements in sanitation and implementation of effective intervention programs have reduced mortality from infectious diseases in most of the world's population. However, increased urbanization--in combination with poverty, pollution, poor sanitation, and inadequate health services--has contributed to a resurgence of infectious diseases, many of which are becoming increasingly drug resistant. The challenge for public health is remediation of the conditions that are fostering this increase. Examples of possible interventions include establishment of coordinated global systems of disease surveillance and control using modern scientific methods and technologies, and accelerated development of promising new drugs or vaccines.

Developing an urban research agenda

While much research is being conducted relevant to the challenges of cities and other human settlements, neither the pace of scientific research nor its transfer into practical application has kept up with the rapidity of urban growth. This situation exists in both the developed and developing worlds.

The generation of new knowledge about how cities and their various components actually operate requires commitment to scientific study far beyond current levels. Research into all aspects of urban development, including the managerial and political approaches to transfer of new knowledge into practice, needs to be intensified. Strengthening of research within developing countries is important for generating new knowledge relevant to the challenges of cities and for promoting collaboration with research institutions in more developed nations.

Important research areas with specific focus on urban settlements include (with no order of priority) the following:

- Integrated approaches to urban systems and their environments
- New housing types, materials, and production methods, with an emphasis on housing for limited-income populations
- Energy systems for densely populated settlements
- Waste treatment, reuse and disposal
- Disease surveillance and control and improved health care services
- Environmental quality, with reference to water, soil, and air
- Economic diversification
- Information and communication technologies, including geographical information systems
- Improved public and private transportation
- Monitoring, maintenance and evolution of physical infrastructure, including improved prediction and mitigation of natural disasters
- Human behavior and adaptability to urbanization-issues of urban crime and other social stresses
- Changing demographic patterns, including redistribution of population and the role of urban areas
- Improving living quality in slum and deteriorated areas, informal neighborhoods, and squatter settlements
- Urban labor markets, community development, and absorption and integration of migrants

Local and national capacity building for sustainable cities

Each urban area constitutes a unique entity in terms of geography, climate, economic and cultural history, and form of governance. Thus site specific solutions to urban challenges should be sought at all stages of investigation, planning, implementation and management. Local expertise and knowledge derived from worldwide research and experience are both required for successful resolution of the problems of each city or metropolitan region.

Planning and Leadership: the improvement of existing cities, as well as planning for future urban settlements, needs to become a new priority discipline in which expertise is developed locally and shared more broadly. Planning includes interaction among major elements of human settlement development, such as housing, transportation, water, waste management and health systems, energy, communications, and job locations. Each urban planning and economic development strategy must take account of complex interactions with the natural

environment and with other human settlements, and must recognize the necessity of a functional ecological resource base for the long-term survival of the city. This is especially important in fragile ecosystems.
Political leaders and managerial and planning experts need to be in continuous communication with each other and with the scientific community. They should be broadly knowledgeable of relevant developments in a wide range of disciplines, including the physical sciences, engineering, agriculture, human health, ecology, economics, geography, architecture, sociology and the political sciences.

Education and Training: the foundation of all capacity for addressing the challenges of urban settlements - whether related to poverty, housing, energy, water supply, sanitation and health, employment, or other components - is the education and training of all segments of the population. Important elements include:

- universal basic literacy and education, founded on up-to-date scientific knowledge. It is especially important to include women and populations in the marginal or informal employment sectors;
- continuing training to provide citizens with the ability to adapt to new employment opportunities, as well as to the changing nature of employment. These changes are associated with rapid shifts in the global economy and with the emergence of new technologies which alter not only products and production processes, but also living and working conditions.

Absorption and Generation of Knowledge: higher education and research are necessary not only to produce new knowledge, but to build the capacity to assess, absorb, and use technology and experience developed elsewhere. Research capability should be developed to address the sustainability issues inherent in the choices and plans of each locality and country. This includes the ability to assess indigenous and traditional knowledge, and to combine it as appropriate with knowledge obtained elsewhere.

Knowledge Centers and Linkages: the nature and complexity of challenges of urban settlements inherently require integrated efforts among education, research, and operational institutions. A barrier to the application of scientific and technological advances has been the sectoralization of education, industrial, public sector, and other science and technology institutions. It is critical to develop interdisciplinary mechanisms for linkages, communication, and cooperation among these sectors. This function can be performed by creating or enhancing integrated educational programs, knowledge centers (such as universities, technology parks, and research centers), and networking initiatives at the local, national, regional, and international levels.

Maintenance and Evolution of Infrastructure: planning and education capabilities should include the ability to foresee, at the outset, the human and other investments needed to maintain the technological systems by which urban settlements function. The evolution, replacement, and modification of systems need to be integral elements of infrastructure concepts. The capability to plan for and mitigate natural and man-made disasters is a critical element in the functioning and survival capacity of urban settlements.

Providing the Environment for Successful Innovation: several non-technological institutional elements are critical to enabling technological innovation and successful handling of challenges of urban settlements. These include:

- legal frameworks, including property ownership and the protection of intellectual property
- effective and flexible standards
- institutions for efficient mobilization of capital resources
- tax and regulatory structures which are conducive to innovative solutions to urban challenges.

Monitoring, Assessing, and Evolving: urban settlements are changing at an unprecedented rate. There is thus an urgent need to measure continuously their status and to monitor changes in order to project future developments and identify appropriate policies. For example, the capacity of the environment to produce basic resources and to process urban wastes must be explicitly evaluated. An effective capability for measurement of parameters such as water quality, air quality, and demographic changes requires an operational organization and ongoing interaction among political leaders, urban planners, the public, and the research community. Scenario building and modeling are important tools to link monitoring, research, and planning.

International cooperation

Cities and other human settlements do not exist in isolation. Action taken locally by one city may generate regional and even global effects. Innovative solutions developed in one city may have application elsewhere. New forms of international cooperation are thus required for developing and sharing information and technologies for the benefit of all urban areas.

Multinational Research Planning: the sustainability of cities in the next century requires a better understanding of the complex interactions among environmental, economic, political, social and cultural factors at local, regional, and global levels. Multinational cooperation is required to assess scientific and technological priorities and to sponsor research efforts encompassing scientists and engineers throughout the world. The commitment of the scientific community to develop collaborative research programs in areas of common interest needs the support of governments and international agencies. While some of these activities can be performed within current budgetary allocations, additional resources will often be necessary.

Information Sharing: the scientific approaches and technological possibilities that find application in one urban location often are very useful in many areas of the world. New communication networks are required that link existing and newly created international and regional research and training centers. Current information and telecommunication networks can be utilized to facilitate new linkages among researchers and urban planners. The exchange of information and sharing of experiences among cities through the world can be enhanced by new communications technologies.

Capacity Building: for international cooperation in science and technology to be effective in supporting sustainable development of urban settlements, the overall competence of all the participants needs to be heightened. Scientists and engineers in all the world's urban communities must be able to evaluate the local requirements, develop competence to solve local and national problems through appropriate R&D, evaluate, assimilate and adapt indigenous and emerging technologies, and effectively participate in regional and international research cooperation. Where necessary, international assistance should be provided for capacity building of local scientific and technological expertise.

Concerted action

Science and technology can produce widespread benefit for future generations only if there is synergy among scientific research, urban planning, and management. The worldwide scientific community must work together and with political and managerial decision makers to identify and implement innovative solutions for meeting the needs of the world's 21st century cities.

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Transition to Sustainability in the 21st Century

2000

During the 21st century, human society faces the daunting yet inspiring task of forging a new relationship with the natural world. This new relationship is captured by "sustainability," a concept that has emerged from a number of international conferences concerned with regional and global trends in population, development, and the environment.* Sustainability implies meeting current human needs while preserving the environment and natural resources needed by future generations.

The Academies of Science of the world, as represented by the signatories to this Statement, offer here a collective set of observations about how the challenges can be addressed. In particular, we focus on what the scientific and technological community can do in the short and longer term, and what the Academies can contribute. In almost every instance, technical and analytical contributions of the scientific and technological community can be critical, but many facets of the problem require economic, social, and political efforts as well.

SCIENTIFIC ACHIEVEMENTS AND FUTURE CHALLENGES

The remarkable effects of science are evident everywhere. The 1999 Declaration on Science of the UNESCO-ICSU World Conference on Science noted: "scientific knowledge has led to remarkable advances that have been of great benefit to humankind. Life expectancy has increased strikingly, and cures have been discovered for many diseases. Agricultural output has risen significantly in many parts of the world to meet growing population needs. Technological developments and the use of new energy sources have created the opportunity for freeing humankind from arduous labor. They have also enabled the generation of an expanding and complex range of industrial products and processes...." At the same time, it noted that "...applications of scientific advances have led to environmental degradation...contributed to social imbalance...and made possible sophisticated weapons."

Even with the many positive achievements in using science for human benefit, the future challenges will be enormous and rapidly evolving. Hunger and poverty still exist in significant parts of the world. Global trends in climate change, environmental deterioration, and economic disparities are growing concerns. These multiple factors have mobilized us, the world's scientific academies, to focus on how to promote the worldwide transition to sustainability more effectively. The key issues that we see are:

- **Meeting the Needs of a Larger World Population: Reducing Hunger and Poverty and Preserving Human Well Being**
  During the next century, many more people will require food, housing, education, nurture, and employment. The world's human population has reached 6 billion and by 2050 is expected to reach nearly 9 billion. How much world population will grow will depend

* E.g., The World Commission on Environment and Development, 1987 (often called "the Brundtland Commission") and the United Nations Conference on Environment and Development,1992 (often called the "Rio Earth Summit").

on choices made about family size and timing and the ability of new generations to implement these choices. About 80 percent of this population will live in areas now part of the developing world, and approximately two-thirds of them will be living in cities. The challenges of providing for the needs of these new urban and older populations are manifold and complex.

Nearly one billion persons are now impoverished or hungry with little or no employment. This number is likely to increase as world population grows. Worldwide disparities in incomes are also widening. Poverty and extreme inequity are incompatible with sustainability. The challenge is to reduce disparities by capacity building and to provide everyone with basic human requirements and with access to the knowledge and resources needed for a meaningful life.

Health challenges will include controlling infectious diseases and containing behavior-related health problems such as illegal drug use, tobacco, alcohol abuse, and obesity, which are already the causes of two-thirds of premature deaths worldwide.

- **Preserving and Maintaining the Environment and the Natural Resource Base**
  The earth's linked physical and biological systems--the atmosphere, oceans, soil, minerals, fresh water, and living organisms--keep the planet fit for life and able to provide for most human needs. The world's ecosystems and the species in them, in addition to their intrinsic value, provide many of the goods and services needed to sustain human life, including food, timber, forage, fuels, pharmaceuticals, and industrial precursors. They also recycle and purify water, mitigate floods, pollinate crops, and cleanse the atmosphere. Humanity now can change the environment on a global scale, as it has with the composition of Earth's atmosphere and may be doing with its climate. Achieving a transition to sustainability will require safeguarding the welfare of biological species and their ecosystems in a rapidly developing world, even as we improve our still modest scientific understanding of these complex ecological processes.

- **Moving Toward Sustainable Human Consumption Patterns**
  Consumption involves the transformation of materials and energy. Such transformations can impact sustainability by either reducing future availability of materials and energy, or by damaging aspects of the environment important to human well being. The forces that drive consumption are multiple and complex. They include economic output, the distribution of wealth and incomes, technological choices, social values, institutional structures, and public policies. Technological progress and innovation have in many countries and economic sectors made more efficient use of energy and materials. But still, global per capita economic activity and the use of energy have increased. As economies and affluence continue to grow, the challenge is to redouble efforts to increase efficiency, reduce damaging impacts, and move towards sustainable patterns of consumptive behavior.

WHAT CAN AND MUST BE DONE BY THE SCIENTIFIC AND TECHNOLOGICAL COMMUNITY

We see three main avenues for our efforts:

- **Achieve a Much More Equitable Access to and Use of Knowledge**

  Improving Education: education is an essential element of all aspects of a transition to sustainability. Yet the quality of education worldwide is inadequate. Continuation of global progress in the reduction of illiteracy is vital for the world of the 21st century. Even in relatively rich countries, the quality of education is quite uneven, and investment in education is in many cases inadequate. Science is often not taught in an exciting, effective way that gives students the ability to think analytically, with the tools and desire to continue their learning throughout their lives.

  Education, particularly in natural and social sciences, is the basis for much productive and innovative economic activity. It is needed for successful adjustments to changing economic opportunities, and thus directly determinative of whether people have jobs and an improved quality of life.

  Education of women is extremely important, including literacy in linguistic, scientific, technological, and legal areas. Women's education also contributes to the success of public health efforts, and to learning by the next generation. It is closely connected with choices concerning the size and timing of families, and therefore with the speed of the demographic transition.

  There are critical roles for the scientific and technological community in education. The natural and social sciences must be present as an integral, core element. Literacy as a practical concept increasingly includes scientific and technical components. The scientific and technological community must be engaged as active partners with educational systems to assure inclusion of quality, exciting, and effective science education at all levels, and to provide a continued assessment of the effectiveness of learning from diverse educational experiences.

  Strengthening Worldwide Scientific and Technological Capacity: use of scientific knowledge and best-available technologies will be essential elements of a transition to sustainability. They can contribute to new energy sources, more efficient methods of food production, better quality products, improved human health, options for institutional changes, and environmentally benign technologies. Science and technology also can provide the tools needed to gauge how well human needs are currently being met and the extent of progress toward sustainability.

  A centerpiece of any strategy to achieve sustainability must be the accelerated development of local capacities in science, engineering, and health throughout the world. The ability of a society to benefit from the continuously expanding store of the world's scientific knowledge depends on human capacities. Citizens, the science and technological community, non-governmental organizations, private enterprises, and local, regional and national governments must all contribute to definition of these needs, and to the ability to use and generate knowledge.

  Building a Global Information Network: much knowledge, know-how, and capacity for improved decision making are now available throughout the world. However, there is a great need for mechanisms that can find and modify what one person, group, firm, or nation knows into something that another person, group, firm, or nation needs and can use. We now have remarkable new tools and opportunities for collaborations and partnerships, and for needs-based interactive efforts, rather than the unidirectional technical assistance of earlier programs.

  New forms of communication technologies make possible a global electronic network that connects scientists, engineers, and health professionals to people in all countries and occupations. This network will allow people to access and assess the scientific and technical knowledge that they need to solve local problems and enhance the quality of their lives, as well as to communicate their own knowledge, insights, and needs to others. Scientists then must use these initial connections as a tool for spreading their knowledge, skills, and values throughout their own nations, including their local communities. By taking full advantage of new information technologies, while strengthening worldwide scientific capacity, the scientific community has an unprecedented opportunity to help close the vast "knowledge gap" among peoples.

  Expanding the Contribution of National Academies of Sciences, Engineering, and Medicine: meeting the potential of science and technology to contribute to human welfare will require high standards of quality. This includes objective assessments of scientific knowledge and its uncertainties, pursuit of best practices, and development of a fuller understanding of the implications of technological directions. The academies, because of their merit-based peer selection process and independence, can help provide those standards of quality at all levels of the science and technology enterprise.

  Many academies are now engaged in the organized provision of independent advice to their governments on policy matters that have important technical content. As more and more academies develop the capacity to provide such advice, they can increasingly be a force for wise decision making.

  In many cases, effective decisions often must be

reached and implemented by countries in cooperative ways. The academies are now engaged in working together, through the International Council for Science (ICSU) and the InterAcademy Panel (IAP), to build our individual and collective capabilities for understanding and meeting global challenges. We also intend to work in cooperation to provide common inputs to international agencies and other decision-making international bodies.

- **Actively Generate New Knowledge**
  The current store of knowledge, while it can and must be much more broadly applied, will not be adequate to meet projected and as-yet-unforeseen challenges to sustainability. The successful production and application of new knowledge is necessary. For example, global health challenges present severe challenges that require new fundamental understanding, as well as new tools arising from that understanding. Social sciences will have an increasing role to play in many areas, such as behavior-related health problems. Making a science of education, so that we much better understand the learning process and how to provide more successful teaching and learning throughout life, is also essential. Fundamental research in environmental and earth sciences, including ecology, biodiversity, climatology, seismology, and new interdisciplinary fields, will help our capability, now very limited, to predict or lessen the consequences of natural disasters and ecological change. Moreover, the global information network and its underlying technology can and certainly will rapidly evolve to provide new possibilities that we cannot now foresee.

More generally, the worldwide research enterprise must be significantly strengthened in four areas:
- sustaining long-term basic research and linking it to societal goals
- coupling global, national, and local institutions into effective research systems
- linking academia, government, and the private sector in collaborative research partnerships
- integrating disciplinary knowledge into interdisciplinary, locally focused, problem-driven research and application efforts.

The worldwide scientific community also needs to develop indicators that inform society over the coming decades how and to what extent progress is being made in moving toward a transition to sustainability. Leading indicators should include:
- global assessments of human needs and environmental support systems
- regional measures of environmental vulnerability
- local evaluations of land use and ecosystems
- measures of progress in key areas such as health, water and air quality, and energy efficiency.

- **Apply the Values of the Scientific and Technological Community to Build Sustainability**

  Science is, in a very fundamental sense, the process of seeking the truth. The values of the scientific enterprise—openness, community, quality, and respect for evidence—are of great importance and application to the search for sustainability. The scientific community must be involved in the broad interactive process of establishing societal priorities, of understanding the implications of policy directions, and in fostering the public understanding and the political will to ensure that progress moves in directions that correspond to those priorities. That involvement is all the more important since we recognize that applications of science and engineering can sometimes produce harm rather than benefit.

  During the past century, conflict—ranging from civil violence to world wars—has consumed or destroyed tremendous amounts of human, institutional, and physical resources. Military programs, even in periods of peace, have consumed resources that could otherwise be devoted to meeting such needs as food, housing, and education. During the decades ahead, conflicts could arise from competition for resources such as food, water, and information. A better understanding of how these events can be mitigated, or made less probable, is essential for a successful transition to sustainability. The natural and social sciences, engineering, and health communities can, together with the many other societal sectors, make important contributions in building international understanding and cooperation, as well as in alleviating the root causes of conflict.

Conclusion

To preserve human well-being over the long term, people need to move toward new ways of meeting human needs, adopting consumption and production patterns that maintain the earth's life support systems and safeguard the resources needed by future generations. Yet if current trends in population growth, consumption of energy and materials, and environmental degradation persist, many human needs will not be met and the numbers of hungry and poor will increase.

Such a dismal forecast need not come to pass. Scientific, technological, and health capabilities—if supported by the necessary worldwide political will and international cooperation, and mobilized by appropriate social and economic policies—can produce substantial progress over the next two decades toward a sustainable human future.

Realizing this progress will demand a threefold effort by the scientific and technological community: to promote the use of existing knowledge more widely and effectively, to generate new knowledge and beneficial technologies, and to work with governments, international organizations and the private sector to promote a worldwide transition to sustainability.

We, as Academies of Science, pledge our cooperation in these efforts.

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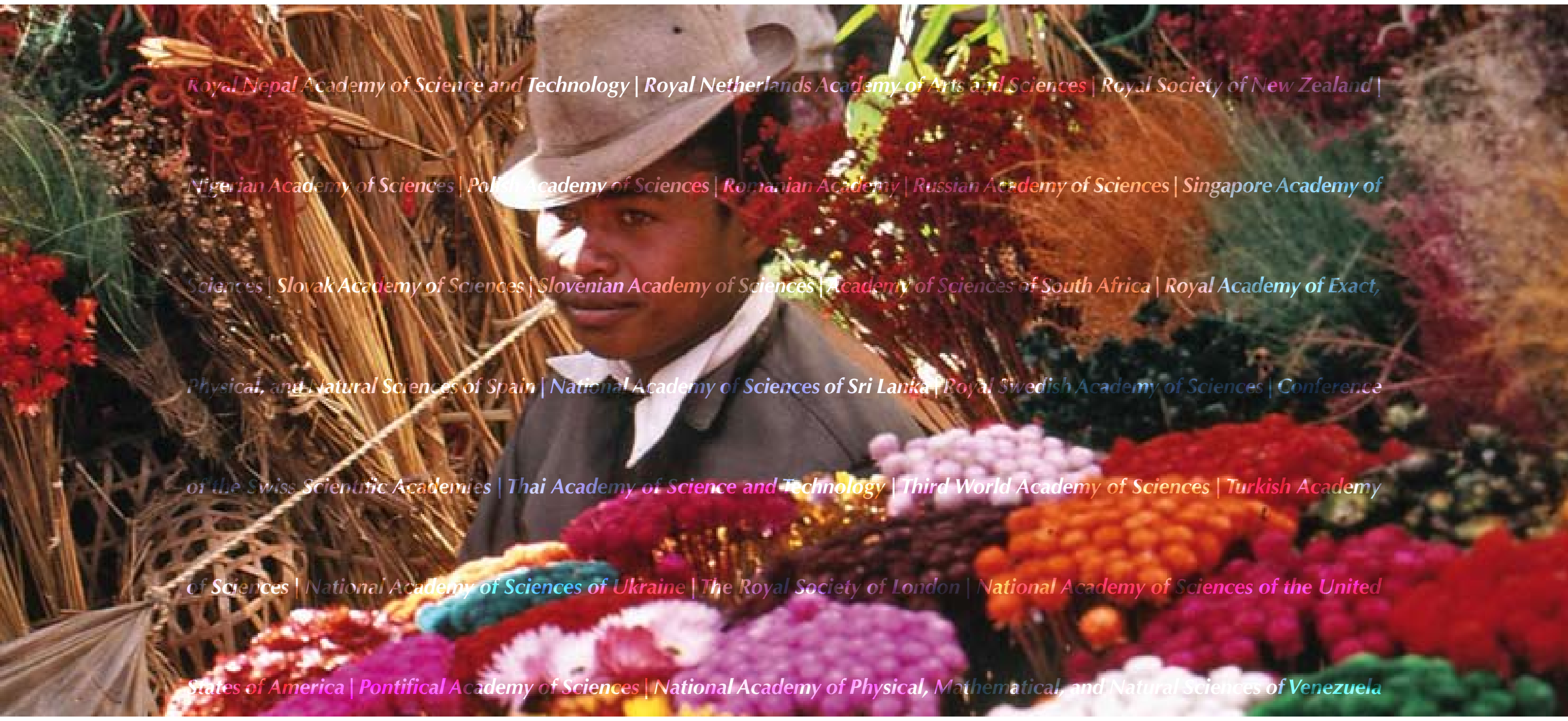

Human Cloning

2003

National academies of science from all parts of the world are united in supporting a worldwide ban on the reproductive cloning of human beings, and in calling for cloning to obtain embryonic stem cells for both research and therapeutic purposes to be excluded from this ban.

Reproductive cloning

Cloning is currently the subject of intense global debate. Some countries have already banned the reproductive cloning of humans. We urge all other countries to introduce and support appropriate regulations to ensure that reproductive cloning is subject to a universal ban.
Human reproductive cloning by somatic cell[1] nuclear transfer (see 'What is cloning?') raises many issues – ethical, social, economic and scientific. It is through scientific research that the prospect of human reproductive cloning has come to be an issue of public policy. Scientists therefore have a special responsibility in the associated public debate.

What is cloning?

Cloning of an organism commonly involves a technique called somatic cell nuclear transfer, where the nucleus of an egg cell (containing its genetic material) is removed and replaced with the nucleus of a somatic cell taken from the body of an adult.
If the reconstructed egg cell is then stimulated successfully to divide, it may develop to the pre-implantation blastocyst stage.
In reproductive cloning, the cloned blastocyst is then implanted in the uterus of a female and allowed to continue its development until birth. However, in cloning for research or therapeutic purposes, instead of being implanted in the uterus the cloned blastocyst is converted into a tissue culture to make a stem cell line for research or clinical applications.

Scientific research on reproductive cloning in other mammals shows that there is a markedly higher than normal incidence of fetal disorders and loss throughout pregnancy, and of malformation and death among newborns. There is no reason to suppose that the outcome would be different in humans. There would thus be a serious threat to the health of the cloned individual, not just at birth but potentially at all stages of life – without obvious compensating benefit to the individual bearing this threat. Moreover, death of a fetus late in pregnancy could pose a serious threat to the health of the woman carrying it. Even on a purely scientific basis, therefore, it would be quite irresponsible for anyone to attempt human reproductive cloning given our current level of scientific knowledge.

It is not beyond the bounds of possibility that scientific knowledge could advance to the point where reproductive cloning by somatic cell nuclear transfer might be accomplished without undue risk. Such a situation would not of itself warrant the lifting of a ban on the practice, which would still face strong ethical, social and economic objections.
We therefore call on all countries worldwide to ban the reproductive cloning of human beings.

Cloning for research and therapeutic purposes

Similarly to reproductive cloning, cloning for research or therapeutic purposes involves generating a human

blastocyst[2] via somatic cell nuclear transfer. However, the crucial difference is that the cloned blastocyst is never implanted into the uterus. Instead, cells isolated from the blastocyst are used to make stem cell lines for further study and clinical applications.

Research studies using such nuclear transfer techniques could be important for improving our basic knowledge of, for example, how the cell nucleus can be re-programmed to switch on the set of genes that characterises a particular specialised cell, or for understanding the genetic basis for human diseases, or for enhancing our understanding of re-programming faulty human genes. A more long-term goal would be to learn how to re-programme somatic cells into stem cells (see 'What are stem cells?') and thus provide a way of obtaining stem cells, genetically compatible with the patient, without any need for the use of eggs and embryos. It is, of course, only justified to carry out this research using human eggs where animal studies fail to provide a suitable alternative.

What are stem cells?

Stem cells are cells that can replicate themselves and also generate specialised cells as they multiply.

Stem cells could be used to generate replacement cells and tissues to treat many diseases and conditions including Parkinson's disease, leukaemia, stroke, diabetes, spinal cord injury and skin conditions, including burns.

Damaged organs or tissues would be colonised with sufficient normal cells, derived from stem cells, to restore their physiology or accelerate repair, or organs replaced by providing stem cells with an appropriate scaffold for their reconstruction.

Stem cells occur at all stages of development from embryo to adult but their versatility and abundance gradually decrease with age. While embryonic stem cells may be able to produce any of the 200 different types of specialised cells that make up the human body, adult stem cells appear to be capable of producing only one or a limited number of types of cell. Recently some have argued that adult stem cells have proved sufficiently versatile and therefore there is no need to derive stem cells from very early human embryos.

We believe the scientific findings that have been reported so far do not support this conclusion.

Therefore research on both adult and embryonic stem cells is vital for a proper evaluation of the prospects of stem cell therapy for the treatment of serious disease and injury.

Nuclear transfer techniques also offer the prospect of therapeutic applications for patients requiring cell, tissue or organ transplants, by producing embryonic stem cells that are genetically compatible with the recipient and thus circumventing the problem of rejection. However, aside from the scientific challenges, there are problems with the cost of customised treatments and obtaining a supply of unfertilized human eggs. At present, as cloning is an inefficient process, it is likely many eggs would be required to make a single embryonic stem cell line. It remains to be established if cloning for therapeutic purposes will be viable clinically. Research into additional strategies to overcome immune rejection is therefore strongly to be encouraged and such research may require the use of human embryonic stem cells derived from early human embryos.

Cloning for research and therapeutic purposes therefore has considerable potential from a scientific perspective, and should be excluded from the ban on human cloning. Both policies should be reviewed periodically in the light of scientific and social developments.

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2) Approximately 5-6 days after a human egg is fertilised, it is known as a blastocyst and consists of about 100 cells, the majority of which are already specialised to form the placenta. Most countries that allow in vitro fertilisation (IVF) treatment allow the use of embryos up to day 14 after fertilisation.

iap statement on

Health of Mother and Child in Developing Countries

2003

Fifteen years after the first international initiative for safer maternity, nearly 600,000 women – more than one every minute – die each year from complications associated with pregnancy and child birth, and 15 million women remain handicapped for the rest of their lives.

At the same time and for the same reasons, 3 million children die either during birth or their first week of life. More than 98% of these deaths occur in developing countries (DC's), where the rate of maternal mortality is at least 80 times higher than in industrialized countries (IC's).

This dramatic situation is most acute in sub-Saharan Africa where the maternal mortality rate is 880 per 100,000 births compared to around 10 in IC's.

In 1996, following the recommendations of IAP, actions against maternal morbidity and mortality in DC's have been launched. Several international meetings were organized (in Canada, France and Italy) and an internet website has been created (www.mother-child.org), linking hospitals, scientists and laboratories. These initiatives now need to be widely extended within the IAP and under the auspices of the newly created IAMP (the *InterAcademy Medical Panel*, which includes academies of medicine from all over the world), in close connection with international organizations, in particular the World Health Organization.

Therefore, the *InterAcademy Panel on International Issues* (IAP) recommends to all national leaders that:

1. the reduction of maternal and childbirth related mortality and morbidity, and the healthy growth of the surviving child, be among the highest priorities in national and international public health programmes;
2. adequate financial resources be allocated for the creation, follow-up and evaluation of targeted programmes for the development of essential obstetrics adapted to the conditions of developing countries; and that appropriate education and training aimed at the diffusion of good clinical practice and quality control be widely developed among health professionals;
3. adequate evaluation of research and validation of local and international perennial solutions be implemented;
4. a network of reference maternity hospitals associated with high standard technical platforms and expert human resources be encouraged and developed.

We, the undersigned academies of science throughout the world, members of the IAP, are convinced that, in the next two decades, this action, with the support of international authorities, the backing of national ministries concerned and the dedicated efforts of the worldwide scientific and medical community, can lead to significant and essential progress for humanity.

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iap statement on

Science Education of Children

2003

Must all children learn science at school?

The answer is "Yes." Science opens young people's minds to the wonders of the natural world; introduces them to the elegance and honesty of scientific endeavours; and equips them with cognitive and problem-solving tools that will serve them well in the future.
Science brings children closer to the natural objects and phenomena that surround them; endows them with a rich understanding of our complex world; helps them practice an intelligent approach to dealing with the environment; and teaches them about the techniques and tools that societies have used to improve the human condition. As children become familiar with the universality of the laws of science, they also learn to recognize science's ability "to create and cement together a unity for humanity."

As citizens, science helps children develop the mental and moral predispositions to imagination, humility, rigour, curiosity, freedom and tolerance – all essential ingredients for peace and democracy.

Therefore, the *InterAcademy Panel on International Issues* (IAP) recommends to all national leaders that:

1 teaching of the sciences to both girls and boys begin in their primary and nursery schools. There is evidence that children, from the youngest age, are capable of building upon their natural and insatiable curiosity to develop logical and rational thought;

2 this teaching should be closely tied to the realities with which the children are confronted locally, in their natural environment and their culture, in order to facilitate continuing exchange with their family and friends;

3 this teaching should be based, to a large extent, upon models of inquiry-based pedagogy, assigning a major role to questioning by the students, leading them to develop hypotheses relating to the initial questions and, when possible, encouraging experimentation that, while simple in terms of the apparatus used, can be performed by children themselves;

4 in this manner one should avoid, as far as possible, a teaching of the sciences which is handed down vertically by a teacher enunciating facts to be learnt by heart, in favour of one which is transformed for children into an acquisition of knowledge which is horizontal, that is, which connects them with nature – inert or living – directly, at the same time involving their senses and their intelligence;

5 links should be established between teachers, via the internet, first within their own country, then internationally, taking advantage of the universal nature of the laws of science to establish a direct contact between classes in different countries on subjects of global interest (e.g. climate, ecology, geography);

6 priority should be given to the networking of schools, and that support should be given – in the same way as IAP and the International Council for Science (ICSU) work on this jointly *via* the website: http://www.icsu.org/events/icsu-iap – to efforts to develop shareable experiments and teaching tools (such as documents and experiment portfolios) to be placed in an electronic commons for all to modify and use.

We, the undersigned science academies throughout the world, members of the IAP, are convinced that, with the support of international authorities, the backing of the national ministries concerned, and the dedicated efforts of the many scientists whom they bring together, a worldwide effort in this area is within reach. This effort is potentially rich in intellectual and societal benefits.

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iap statement on

Scientific Capacity Building

2003

All countries now recognize the intimate relationship between science, technology and sustained economic development. Yet disparities in scientific and technological capacities between nations continue to grow – a trend accompanied by increasing disparities in economic and social well-being. Per-capita income in “high-income” countries is 60 times greater than per-capita income in “low-income” countries; meanwhile, per-capita research expenditures in developed countries is 220 times greater than per-capita research expenditures in the poorest developing countries.

Over the past two decades, the North-South divide in scientific and technological capacities has been accompanied by another unwelcome divide: growing disparities within the South between scientifically proficient countries (for example, Brazil, China, India, Malaysia, and South Korea) and scientifically laggard countries (most notably, the nations of sub-Saharan Africa).

The *InterAcademy Panel on International Issues* (IAP) has sought to address these trends by helping to nurture the creation of merit-based science academies in nations where they do not exist and to strengthen the capacities of science academies in countries where they do exist but function far below their potential. It is a compelling challenge (for example, of the world’s 139 developing countries, only 40 have merit-based science academies). Yet, the IAP is convinced that strong merit-based science academies provide critical indigenous mechanisms for promoting scientific excellence, bringing the fruits of scientific research closer to national economic development strategies, and devising science-based solutions to issues related to resource conservation and use.

To date, the IAP has held regional workshops on scientific capacity building for academies in Africa, South America and the Caribbean region, as well as for academies in countries with predominantly Muslim populations.

The IAP recognizes that merit-based science academies represent only one key player in efforts to build enduring scientific and technological capacities on national, regional and international scales. Therefore, in a broader perspective, the IAP recommends the following:

1. creation of national science and technology strategies that specify research and development priorities and funding commitments. Such strategies should be developed in full consultation with the nation’s scientific and technological communities;
2. continued development of centres of scientific excellence, especially in the South. International funding agencies should work closely with national and regional scientific institutions throughout the developing world to create centres of excellence in a broad range of disciplines. These centres should promote research excellence, comprehensive training, and the exchange of both personnel and information;
3. expansion of programmes for North-South and South-South scientific cooperation not only through the activities of centres of excellence but through bilateral and global initiatives sponsored by national governments and international organizations;
4. targeted programmes designed to meet the special needs of women and minorities interested in pursuing careers in science. These potentially critical groups are often woefully under-represented in the scientific community. This vast untapped source of talent must not be neglected when seeking to build and strengthen scientific and technological capacities worldwide.

We, the undersigned science academies throughout the world, members of the IAP, are convinced that building scientific and technological capacity is necessary for the promotion of sustainable development; that this implies the local creation of centres of scientific excellence (possibly academies); and that this entails both a mobilization of all intellectual resources and renewed international efforts for scientific cooperation.

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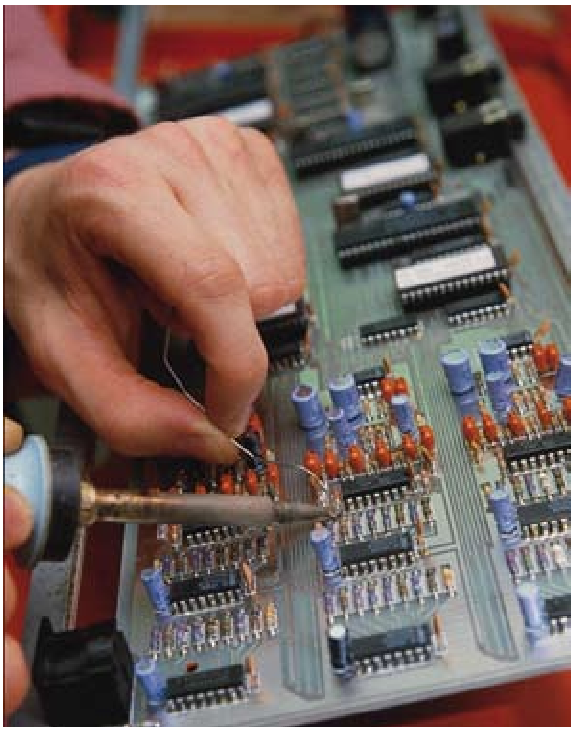

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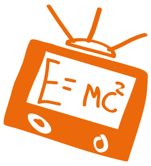
iap statement on

Science and the Media



2003

Should the scientific community interact more closely with the media in efforts to explain the work of scientists to a larger public?

Of course, it should. But the more difficult questions involve the responsibilities that the scientific community should shoulder in such efforts and the concrete measures that should be taken to enhance the capabilities of both scientists and scientific institutions in their interaction with the media.

On the one hand, the public often turns to science for answers to difficult issues that science itself may not be able to provide. On the other hand, today's cutting-edge scientific research does not readily lend itself to explanations that can be easily conveyed through the media, especially broadcast media. Today's cutting edge scientific research, moreover, often raises ethical issues that must be discussed among a broad cross-section of society before a consensus can emerge. In a sense, advances in science have raised immensely complicated issues that science alone cannot answer.

Fierce public resistance to the cultivation and distribution of genetically engineered food crops, even in developing countries suffering from malnutrition and hunger, indicate that the public – both in the North and South – is increasingly unwilling to assume that the products of scientific research are safe just because scientists say so. Likewise, public confusion – and often doubt – concerning the ethical propriety of cloning, whether for reproductive or therapeutic purposes, suggests that the scientific community has been unable to clearly explain such difficult issues to the public or, conversely, that the public is not listening when scientists do.

The scientific community and media each have distinctive roles to play within this increasingly complicated relationship between science and society. That's why a fruitful relationship between the two – one that proves of value to the societies in which they both function – depends on each understanding and respecting the other's roles. Therefore, the *InterAcademy Panel on International Issues* (IAP) supports efforts to strengthen and expand:

1. training programmes for building the capacity of science academies to interact with the media, paying particular attention to the needs and circumstances faced by academies in the developing world, and to the increasing conflicts over scientific issues in industrialized countries;
2. programmes for media representatives to visit scientific laboratories in order to learn more about the work of scientists, paying particular attention to the needs and circumstances faced by print and broadcast media representatives in the developing world;
3. workshops organized by academies with public information offices (PIO) designed for academies that do not have such offices to provide practical information on how PIOs function;
4. workshops designed to improve the ability of scientists to engage the public in their work by developing the skills necessary to give public lectures, improve print and electronic material for public consumption, and serve as consultants on science-related television programmes, films and videos.

We, the undersigned science academies throughout the world, members of the IAP, support any effort done jointly by the scientific and the journalistic communities aiming at enhancing the fluidity of the information about discoveries in science, and at favouring public debates of high objectivity on the ethical issues which they may raise.

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iap statement on

Access to Scientific Information

2003

The truth that *knowledge is power* is particularly emphasized in today's world.

Science is the most successful means of knowledge creation. Because it deals exclusively with arguments based on evidence that can be independently confirmed by others, science is by its very nature an endeavour that requires openness, and it thrives on a complete and honest public reporting of results. Access to the vast and varied literature that has been generated by scientific research, and to the numerical data that are being collected in public research endeavours, is essential to advances in human health, improvements in agriculture, and the preservation of the natural environment that sustains our life. It is also critical for the creation of new technologies that benefit humankind. In addition, scientific knowledge facilitates our understanding of our place in the universe.

Yet most scientists and research laboratories in developing countries cannot afford the journal subscriptions, or have to pay for access to the databases that exist in more economically advanced nations. All nations must have access to the accumulation of scientific knowledge in order to work toward a better future for all people.

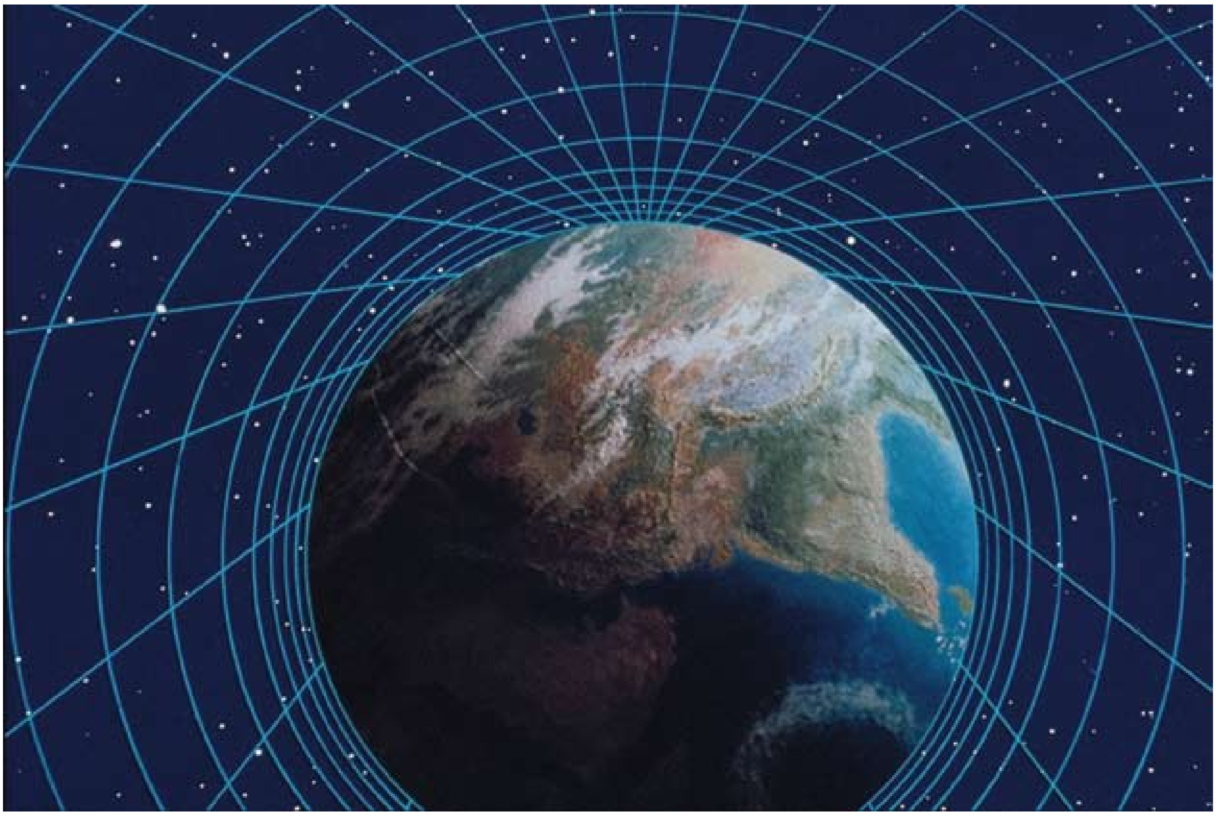
In an era in which global dissemination of the published results of scientific research is increasingly accomplished electronically, it is possible to give access to this body of knowledge to scientists worldwide, allowing them to participate in the scientific process and advance the scientific enterprise. Access to current, high quality, scientific databases and literature allows scientists in developing countries to base their own work on up-to-date advancements in their field and to strengthen the scientific infrastructure of their own countries. Unfortunately, however, scientists and research institutions in the developing world can rarely afford the high cost of these knowledge resources.

The *InterAcademy Panel on International Issues* (IAP), recognizing that many efforts in this regard are under way worldwide and that the business models of scientific publishers need to be taken into consideration, recommends that:

1. electronic access to journal content be made available worldwide without cost as soon as possible, within one year or less of publication for scientists in industrialized nations, and immediately upon publication for scientists in developing countries;
2. journal content and, to the extent possible, data upon which research is based, be prepared and presented in a standard format for electronic distribution to facilitate ease of use;
3. journal content be archived collectively, either by private or government organizations;
4. governments and publishers work together to raise awareness, in the scientific community, of the availability of free electronic access to scientific journals;
5. scientific databases obtained by intergovernmental organizations (for example in meteorology and epidemiology) be made available without cost or restrictions on reuse.

For both the publishers of scientific journals and the intergovernmental organizations, providing free content to developing countries will have a minimal financial impact. Sales to these countries are small compared to the revenue generated from sales to more developed countries. Moreover, the cost of implementing the technology for custom web access for selected countries is low (for details, see: http://www.nap.edu/info/free_ip.html).

We, the undersigned science academies throughout the world, members of the IAP, are convinced that, with the support of international authorities, the backing of the ministries concerned, and the cooperation of scientific publishers, worldwide dissemination of scientific knowledge can be achieved; and that the benefits to the global scientific community, and to developing countries in particular, will be immense.



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iap statement on

Biosecurity

2005

Knowledge without conscience is
simply the ruin of the soul.
F. Rabelais, 1532[1]

In recent decades scientific research has created new and unexpected knowledge and technologies that offer unprecedented opportunities to improve human and animal health and environmental conditions. But some science and technology can be used for destructive purposes as well as for constructive purposes. Scientists have a special responsibility when it comes to problems of "dual use" and the misuse of science and technology. The 1972 Biological and Toxin Weapons Convention reinforced the international norm prohibiting biological weapons, stating in its provisions that "each state party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain: microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic or other peaceful purposes." Nevertheless, the threat from biological weapons is again a live issue. This statement presents principles to guide individual scientists and local scientific communities that may wish to define a code of conduct for their own use.

These principles represent fundamental issues that should be taken into account when formulating codes of conduct. They are not intended to be a comprehensive list of considerations.

1 **Awareness.** Scientists have an obligation to do no harm. They should always take into consideration the reasonably foreseeable consequences of their own activities. They should therefore:
- always bear in mind the potential consequences – possibly harmful – of their research and recognize that individual good conscience does not justify ignoring the possible misuse of their scientific endeavour;
- refuse to undertake research that has only harmful consequences for humankind.

2 **Safety and Security.** Scientists working with agents such as pathogenic organisms or dangerous toxins have a responsibility to use good, safe and secure laboratory procedures, whether codified by law or common practice.[2]

1) "Science sans conscience n'est que ruine de l'âme."
2) Such as the WHO Laboratory Biosafety Manual, Second Edition (Revised).

3 **Education and Information.** Scientists should be aware of, disseminate information about and teach national and international laws and regulations, as well as policies and principles aimed at preventing the misuse of biological research.

4 **Accountability.** Scientists who become aware of activities that violate the Biological and Toxin Weapons Convention or international customary law should raise their concerns with appropriate people, authorities and agencies.

5 **Oversight.** Scientists with responsibility for oversight of research or for evaluation of projects or publications should promote adherence to these principles by those under their control, supervision or evaluation and act as role models in this regard.

These principles have been endorsed by the following national academies of science, working through the InterAcademy Panel

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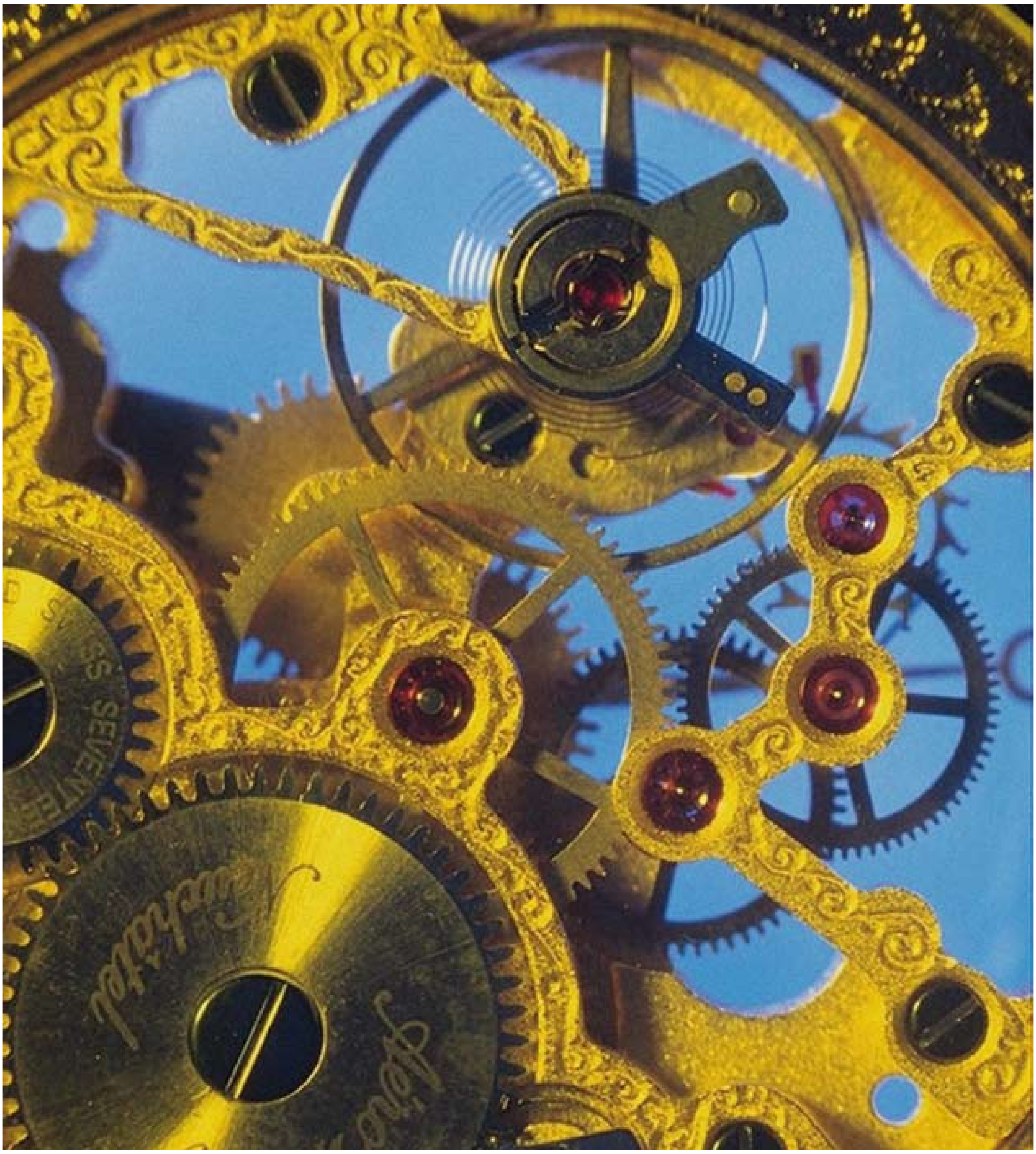
iap statement on

The Teaching of Evolution

2006

We, the undersigned Academies of Sciences, have learned that in various parts of the world, within science courses taught in certain public systems of education, scientific evidence, data, and testable theories about the origins and evolution of life on Earth are being concealed, denied, or confused with theories not testable by science.

We urge decision makers, teachers, and parents to educate all children about the methods and discoveries of science and to foster an understanding of the science of nature. Knowledge of the natural world in which they live empowers people to meet human needs and protect the planet.



We agree that the following evidence-based facts about the origins and evolution of the Earth and of life on this planet have been established by numerous observations and independently derived experimental results from a multitude of scientific disciplines. Even if there are still many open questions about the precise details of evolutionary change, scientific evidence has never contradicted these results:

1 In a universe that has evolved towards its present configuration for some 11 to 15 billion years, our Earth formed approximately 4.5 billion years ago.

2 Since its formation, the Earth – its geology and its environments – has changed under the effect of numerous physical and chemical forces and continues to do so.

3 Life appeared on Earth at least 2.5 billion years ago. The evolution, soon after, of photosynthetic organisms enabled, from at least 2 billion years ago, the slow transformation of the atmosphere to one containing substantial quantities of oxygen. In addition to the release of the oxygen that we breathe, the process of photosynthesis is the ultimate source of fixed energy and food upon which human life on the planet depends.

4 Since its first appearance on Earth, life has taken many forms, all of which continue to evolve, in ways which palaeontology and the modern biological and biochemical sciences are describing and independently confirming with increasing precision. Commonalities in the structure of the genetic code of all organisms living today, including humans, clearly indicate their common primordial origin.

We also subscribe to the following statement regarding the nature of science in relation to the teaching of evolution and, more generally, of any field of scientific knowledge:

Scientific knowledge derives from a mode of inquiry into the nature of the universe that has been successful and of great consequence. Science focuses on (i) observing the natural world and (ii) formulating testable and refutable hypotheses to derive deeper explanations for observable phenomena. When evidence is sufficiently compelling, scientific theories are developed that account for and explain that evidence, and predict the likely structure or process of still unobserved phenomena.

Human understanding of value and purpose are outside of natural science's scope. However, a number of components – scientific, social, philosophical, religious, cultural and political – contribute to it. These different fields owe each other mutual consideration, while being fully aware of their own areas of action and their limitations.

While acknowledging current limitations, science is open ended, and subject to correction and expansion as new theoretical and empirical understanding emerges.

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