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# World Commission on the Ethics of Scientific Knowledge and Technology

## Draft 3

# Report on Science Ethics

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## Introduction

"Science ethics" refers to the principles according to which scientific activity should be conducted and to the mechanisms by which conformity to such principles is promoted, fostered or ensured.

An ethical approach to science is not an external imposition. On the contrary, science depends on ethical values that are intrinsic to the quest for knowledge and understanding, such as integrity, truth and respect for reasoned argument and evidence. However, the practical pressures under which science is conducted cannot guarantee that such values always be recognized or honoured. Furthermore, public support for science depends on the perception that knowledge is not only pursued diligently and impartially for its own sake, but also contributes to broader human needs or well-being. Science thus connects to external values that neither clash with nor simply duplicate its own internal logic.

The field of science ethics is broad and in some respects controversial. It concerns not just professional scientists but also all those with responsibility for research policies and the communication of scientific knowledge to relevant audiences. It is thus considerably broader than "research ethics", which refers only to one specific area of professional conduct. The wider group of responsible stakeholders includes UNESCO, in pursuance of its established normative mandate, but also states, with respect to the implementation of internationally agreed principles, and bodies such as professional associations, universities and academies, without which ethical principles cannot be embedded in routine scientific practice.

The thematic and disciplinary scope of science ethics is also broad. As defined by Article 1(a)(i) of the 1974 Recommendation on the Status of Scientific Researchers, science "signifies the enterprise whereby mankind, acting individually or in small or large groups, makes an organized attempt, by means of the objective study of observed phenomena, to discover and master the chain of causalities". There might be scope for debate whether this view of science extends to the human sciences, where the notion of "causality" may not be appropriate. In addition, current debates in epistemology might call into question the kind of "objectivity" taken for granted in 1974. Nonetheless, the emphasis on science as a socially organized activity characterized by its structures and procedures ensures that the definition is inclusive with respect to the many different ways of doing science. Article 1(a)(i) of the 1974 Recommendation further stresses this point by adding two additional features to the definition. First, science "brings together in a coordinated form the resultant sub-systems of knowledge". The various *sciences* are thus explicitly components of *science*. Secondly, science provides humankind with knowledge that it can use "to its own advantage". No definitional line is drawn, therefore, between science and technology or between basic and applied science. Finally, Article 1(a)(ii) explicitly states, for the avoidance of doubt, that "The expression 'the sciences' (…) includes the sciences concerned with social facts and phenomena", at least in so far as they comprise "a complex of fact and hypothesis, in which the theoretical element is normally capable of being validated".

There is a body of internationally agreed ethical principles for science, as thus broadly defined, that includes universal normative documents (e.g. the 1974 Recommendation on the Status of Scientific Researchers, the 1999 Declaration on Science and the Uses of Scientific Knowledge); regional agreements (e.g. within the European Union and the African Union); and agreements on matters other than science ethics that include principles of direct relevance to science

ethics (e.g. the 1992 Convention on Biological Diversity). While these principles are of continuing relevance, and provide valuable guidance for practical action to support a general ethical framework for scientific conduct, they are neither complete nor fully consistent. The extensive network of complementary principles adopted in professional or institutional settings helps to provide a more complete framework but, given their diversity and lack of coordination, such principles do not guarantee consistency. Furthermore, their authority typically does not extend beyond those individuals or institutions that have subscribed to them.

Mechanisms for ensuring practical implementation of agreed ethical principles are themselves diverse and uneven.

A framework for science ethics that can be evaded with ease and impunity by those who reject it would necessarily fall short of the ambitious objectives set by existing international normative instruments.

Since the existing international framework is incomplete and only partly operative, it is an open question whether established principles require development, expansion, refinement and perhaps even revision in light of changing circumstances or emerging ethical challenges. Such challenges may derive from issues that have recently acquired enhanced relevance to the international community (e.g. in the various areas covered by environmental ethics) or from scientific and technological advances that appear to undermine or destabilize existing ethical principles or mechanisms (e.g. nanoscience and the various forms of nanotechnology, especially in so far as they may converge with other areas of scientific and technological development, such as in the life sciences).
UNESCO is therefore called upon to reflect, on an ongoing basis, on ethical concerns that may, after due consideration, call for action to regulate scientific conduct in specific ways. The current basis for such reflection is provided by the decision adopted by the Executive Board, at its 175th session in 2006, to endorse the recommendations made by COMEST to the Director-General following its 2006 Extraordinary Session. These were as follows:[1]

> "1. Member States should be reminded of the principles adopted by them in the 1974 Recommendation on the Status of Scientific Researchers, and this instrument, together with the Declaration on Science and the Use of Scientific Knowledge, should be taken as a general reference for future works;
> 2. An assessment, from an ethical perspective, of the implementation of previous work of UNESCO in this area was deemed necessary, especially the 1974 Recommendation and the Declaration on Science and the Use of Scientific Knowledge.
> 3. The work that has been undertaken by UNESCO so far, such as the collection of codes of conduct worldwide, the critical and comparative analysis of existing codes, as well the elaboration of educational tools should be supported and encouraged;
> 4. Further international reflections and consultations should be carried out and fostered in order to identify a general ethical framework to guide scientific activity that will cover other stakeholders beyond the focus on scientists;
> 5. UNESCO, with the advice of COMEST, should work out such a general ethical framework;
> 6. The subsequent elaboration and/or implementation of specific codes of conduct for scientists should rely on Member States and the scientific community;

[1] Document 175 EX/14, p. 7.

> 7. In this regard, it is necessary to set up a wide participatory process, involving all stakeholders as well as the society at large with a view to initiate actions in relevant sectors in the society."

The two-level structure of this mandate should be stressed. UNESCO is invited to *act* in certain specific areas, but to *reflect* on science ethics as a whole. Effective action "in relevant sectors in the society" requires both shared thinking within the terms of "a general ethical framework to guide scientific activity" and differentiated responsibilities consistent with diversified institutional competence.

The task of COMEST, similarly, is wide-ranging. In all areas of concern, COMEST is called upon to provide independent advice to the Director-General of UNESCO by formulating, on a scientific basis, ethical principles that can shed light on the various choices and impacts occasioned by new advances in scientific and technological fields, thus fostering a constructive ethical dialogue on the values at stake. Such advice should be sensitive to the institutional competence of UNESCO, but not restricted by it.

The structure of this report reflects these concerns. It first reviews the key ethical challenges for science, many of which have unclear implications for the very diverse institutions involved. Section 3 analyzes the existing normative framework for science ethics, emphasizing its diversity and the very different levels of competence involved. In section 4, past and ongoing COMEST work on science ethics is reviewed and specific conclusions drawn on both substantive and procedural issues. Finally, section 5 formulates recommendations designed to ensure that the decisions of the Executive Board are adequately followed up. The stakes are high in this respect. Given current challenges, it cannot be assumed that, in the absence of an appropriate "general ethical framework to guide scientific activity", science will necessarily conform to the ethical standards laid down in the internationally agreed normative instruments. As a result, the integrity of science may be damaged and its capacity to contribute to human well-being impaired. Science ethics is not an optional add-on to science, but rather a constitutive feature of it.

## Key ethical challenges for science

Science ethics does not currently have an up-to-date, comprehensive and consensus-based normative framework. In view of the fragmented and in some respects dated ethical basis for science (see section 3), there are a number of major ethical challenges that require new reflection and, possibly, new action.

### INCOMPLETE PRINCIPLES

There is no comprehensive normative instrument that deals exclusively with science ethics and addresses all aspects of the subject. As a result, any attempt to analyze the existing normative framework must start from a disparate set of documents, adopted at different times and levels and for different purposes, and the content of which is not coordinated. Section 3 provides such an analysis. For the purposes of this section, it suffices to note that the 1999 Declaration on Science and the Uses of Scientific Knowledge makes no reference to the 1974 Recommendation on the Status of Scientific Researchers, even though they cover much of the same ground.

Unsurprisingly, the various components of the existing normative framework dovetail imperfectly. In some cases, different documents may overlap, with the result that distinct and possibly incompatible principles may apply to the same issue. In other cases, there may be gaps covered by none of a range of potentially applicable instruments. The likelihood of such gaps is increased by the dynamic of scientific and technological change, which redraws the boundaries of disciplines and scientific fields (see section 2.3).

Furthermore, even considered in isolation, some normative instruments may appear dated or even obsolete. This affects not so much the general principles they state, which are as durable as the basic conception of science that underpins them, as the language in which they are expressed, the institutional setting they presume, and the mechanisms they are related to. As discussed in detail in section 3.1, the 1974 Recommendation on the Status of Scientific Researchers is particularly open to challenge in this respect.

What this entails for science ethics at international level is the need to establish a basis for practical discussion, involving all relevant stakeholders and taking account of the very different levels at which ethics may call for institutionalization, on the new ethical developments that may be required by contemporary social pressures or by the internal logic of ethical deliberation itself.

### NEW SOCIAL/INSTITUTIONAL CONTEXTS

Science is a social activity, and not simply an epistemic one. To be a scientist is to be a certain kind of professional, and not simply to be the producer of a certain kind of knowledge. These points, which are familiar from the contemporary sociology of science, also follow directly from the definition adopted by the 1974 Recommendation on the Status of Scientific Researchers. The straightforward implication is that changes in the social or institutional context within which science is conducted have consequences for science and for scientific knowledge. It is generally agreed that the context has indeed undergone significant changes in recent decades.

Many of these changes are a consequence of the considerable expansion of student numbers along with forms of globalization that have combined to erode traditional academic communities and self-understandings. While there are many

positive aspects to this change, it has also undermined the historically constituted basis of scientific integrity without, hitherto, producing robust alternatives. The challenge is all the greater that any global standard of integrity now needs to incorporate a greater diversity of cultural practices and value systems than in the past.

Expansion and globalization have also coincided with growing commercial pressures, due to the movement towards privatization in some countries, greater pressure to rank and to evaluate researchers and institutions, public funding retrenchment in higher education and research, and the high profitability expectations associated with cutting edge development, especially in the life sciences. One practical consequence has been a tendency towards contractualization of scientific research, with conditions attached that may conflict with traditional principles of open access and public benefit.

It is controversial whether the frequency and severity of scientific research misconduct – fabrication, falsification and plagiarism – and of questionable research practices have increased. The problems may, after all, be simply more extensively studied and investigated. Nonetheless, even the possibility that the institutional conditions in which science is conducted may be undermining science ethics is a matter for concern and deliberation.

Finally, new expectations addressed to science, particularly in connection with environmental issues, point towards the need for a more expansive conception of science ethics, of which the much-discussed precautionary principle is exemplary. Broader conceptions of risk and uncertainty are current within contemporary societies and create challenges not just for the predictive capacity of science but also for its ability to maintain public trust. While there is general agreement that science should take responsibility for its unintended consequences and contribute to the capacity of humankind to deal with ever more complex and long-range causal chains, it is unclear which specific responsibilities should be shouldered by which scientists or scientific institutions in this regard.

## SCIENTIFIC AND TECHNOLOGICAL CHANGE

Quite apart from the changing social and institutional context, the internal development of science itself is producing new ethical challenges. These may require new principles or refinement of existing principles. They may also, and perhaps are more likely to, require development of new mechanisms for the institutionalization of ethics that are adapted to a changed environment.

The key scientific changes tend to fall into three distinct but interrelated categories.

First, scientific and technological development throws up new objects that may have ethical implications. This possibility is most familiar from bioethics, but can also be generalized. For instance, it should at least be considered whether nanoscale manipulation raises specific issues even without reference to actual or hypothetical technological applications. Ultimately, one might ask whether the very definition of science adopted in the 1974 Recommendation on the Status of Scientific Researchers, as quoted in the introduction to this report, requires revision. The fact that such a conclusion would undoubtedly be premature at the present stage of scientific and technological development does not mean that the question should not be asked on an ongoing basis.

Secondly, and much more importantly in light of current concerns in public debate, scientific and technological development produces new capacities for action and

therefore new risks of ethically undesirable consequences, whether intended or unintended. Examples are familiar and largely overlap with the areas referred to in section 2.2 in which science and technology give rise to new fears and new expectations. The possibility that new technologies might, through deliberate use or accidental release, cause serious and irreversible harm calls for new forms of vigilance that affect both the burden and the standard of proof. In particular, it is a major challenge – exemplified by debates on genetically modified crops and foods and on atmospheric and electromagnetic pollution – to establish scientifically sound ways of dealing with public debates about competing unproven hypotheses that claim to demonstrate or to dismiss harmfulness.

Thirdly, new scientific and technological developments may reshape the professional landscape of science in ways that challenge established institutional ethics procedures. A relevant example in this respect is converging technologies: the reshaping of connections between areas of technology might undermine or destabilize existing ethical frameworks. For example, codes of conduct or ethical codes based on disciplines and enforced by disciplinary scientific associations might be rendered obsolete by people working in cutting-edge converging technology, whose work may escape existing normative frameworks or regulations. There is a need, therefore, to adapt on an ongoing basis the institutional framework guiding scientific conduct in order to ensure that cutting-edge research is not escaping the purview of ethics. Action at a global level may be required to make scientists aware of their social responsibilities and to help Member States develop and implement mechanisms to inform about the pros and cons of such technological developments.

## ACCESS TO SCIENTIFIC INFORMATION

At the most general level, access to scientific information may be regarded as a human right. Article 27(1) of the Universal Declaration of Human Rights unambiguously declares, for all human beings, the right "to share in scientific advancement and its benefits". The benefits of scientific advancement could, conceivably, be shared equitably while science remains under the restrictive control of certain social groups, corporate entities or states. However, the Declaration specifically refers not just to the benefits but to scientific advancement itself. This implies equitable participation in the global community of science, and therefore a fair basis for access to scientific information.

What this entails in practice is less clear-cut, particularly as several distinct issues are involved, including the distinct intellectual property regimes of copyright and patent, mobility of scientific personnel, and confidentiality for research considered sensitive by its funders. The 1974 Recommendation on the Status of Scientific Researchers does state explicitly "that open communication of the results, hypotheses and opinions – as suggested by the phrase 'academic freedom' – lies at the very heart of the scientific process, and provides the strongest guarantee of accuracy and objectivity of scientific results".[2] Similarly, and more vaguely, the 1999 Declaration on Science and the Uses of Scientific Knowledge does enshrine "the importance of total, unrestricted access to scientific research and education and to information and data" (article 16). The institutional implications are, however, left unspecified except with respect to the right of scientists to publish their work.

Clarification of such matters is an important issue for science ethics. Contemporary challenges such as changing modes of publication, new

[2] The quotation marks around "academic freedom" are in the original text. The phrasing may require consideration with respect to its current acceptability.

commercial and security pressures, evolving technologies, etc., are redistributing the conditions of access to scientific information in ways that risk creating new barriers detrimental to developing countries even as they remove some traditional obstacles to the circulation of scientific information.

Publication issues are of great significance in this respect, and ongoing debates about open access deserve careful ethical consideration. This will be facilitated if open access is not regarded, as it sometimes is, as an intellectual property regime. In fact, open access says nothing about copyright or its absence. In addition, it should be noted that the phrase “open access” does not prejudge how such access is to be ensured and how it affects the scientific information available. Commercial open-access models effectively shift part of the cost of publication from the reader to the author, while typically maintaining traditional quality control. Whether, on balance, such a move favours or hampers the equitable participation of developing-country scientists in global science is a question that would require careful study. Non-commercial open-access models tend to require third-party funding and may also entail reduced quality control. The distributive implications, again, are not clear-cut. Finally, the Internet is itself a medium of publication, and not simply of dissemination of published material. However, while self-published information may be “open-access” for the reader, it may not have the same scientific status as other information available through the same medium. Whether the indiscriminate nature of information available via Internet raises ethical issues is a matter for careful consideration.

However, no consideration of access to scientific information that focuses exclusively on modalities of publication can be regarded as adequate. Open access to published material does not and cannot ensure effective access to unpublished material or to data and other background information, which may be more important for availability than the written-up version of the results. Nor is this concern merely abstract. It is well known that commercial funding of research – which is of growing significance in many areas, including in particular the life sciences – may involve contractual limitations on publication of results. Similarly, editors of scientific journals have expressed major concerns about the difficulties in reviewing papers in the absence of the data on which they are based, and have in some cases introduced requirements to make available such data to referees, typically on a confidential basis. It is therefore equally important to reflect ethically on what should be published – and how – and on access to resources such as data that are not in any strict sense publishable.

## EDUCATION, TRAINING AND AWARENESS-RAISING

Science ethics cannot be reduced to principles, or even to institutional mechanisms to investigate and if appropriate punish unacceptable behaviour. The challenge is to embed ethics in routine scientific practice: to make it, as already emphasized, not an optional add-on but a constitutive component of science. In order to meet this challenge, it is essential to act at a range of different levels to build awareness of science ethics among not just professional scientists but also technicians and all people actively working in science and technology. Avoiding deliberate misuse of science is undoubtedly an important ethical issue, but it is unlikely that it can be addressed solely or even mainly through education. Avoidance of inadvertent failure to meet high ethical standards, on the other hand, depends on education and training, although it cannot be achieved without adequate institutional oversight.

Consideration should therefore be given to gaps in existing provision of education and training and possible action, with a particular focus on international coordination and cooperation and on capacity building in developing countries. If

it is the case that, in certain areas, not enough is being done, there are potentially important practical consequences, which concern the capacity of science and technology to respond to human needs or well-being, possibly harmful side-effects, and public trust in science.

Finally, awareness of ethical issues in science and of the steps taken by relevant institutions to promote science ethics can contribute usefully to public trust in science. There is much existing and valuable work in outreach, public information and popularization, and to a lesser extent in effective public participation in social choices about science and technology. There may however be gaps that need to be addressed by new kinds of initiatives.

## GLOBAL GOVERNANCE

The need to embed ethics in routine scientific practice establishes a strong connection between science ethics and science policies. The integrity and credibility of science do not depend solely on the values, attitudes and behaviour of individual scientists. There are crucial background institutional conditions, defined in particular by science policies, for which individual scientists cannot be held responsible.

Ethics is therefore not just a matter of principles, but also of governance. At national level, ethical institutions and mechanisms may need strengthening, especially in developing countries. Action may also be required to address gaps in international coordination at regional and global level. In order to reflect on what might need to be done, it is important to clarify what the global governance might entail and what its ethical features might look like.

In general terms, science governance depends on answers to three interrelated questions:

1. How to build response to key social needs – or, more generally, promotion of human well-being – into science policies, in the differentiated ways appropriate to the various levels at which the interface operates (priority setting and programming, funding, higher education, institutional design in research systems, etc.)?

2. How to weave together the necessary autonomy of science, which is internally connected to its integrity, with accountability and with responsiveness to externally generated priorities? This is of course a tension, not a clash: scientists as citizens may well share the externally generated priorities, but cannot be assumed or required to do so.

3. How to channel the results of science into a policy process that can actually address social produce the intended outcomes by which it is legitimized?

Adequate answers to these questions may be expected to have positive, mutually reinforcing effects on both the conduct of science itself and public understanding of and attitudes towards science. In turn, such positive effects serve as favourable preconditions for more dynamic science backed and effectively utilized by more vigorous policies.

Among the key issues to be addressed within a framework for global governance of science are science divides (notably in relation to development) and the related capacity-building challenges, private-sector science, research policies, and applications of science to concrete policy issues. The challenge in this regard

is not to establish some kind of global regulatory mechanism – for which UNESCO, in particular, would not be competent – but rather to facilitate cooperation, interchange, coordination etc. of existing mechanisms and across disciplines in order to improve the effectiveness of ethical frameworks that already exist.

## Existing normative framework for science ethics

The existing normative framework may be in some respects out of date, it may not be comprehensive, and it may be fragmented. Nonetheless, it is richly developed and offers an indispensable starting point for future development.

### 1974 RECOMMENDATION ON THE STATUS OF SCIENTIFIC RESEARCHERS

As its title implies, the 1974 Recommendation is not simply an ethical document, but also covers a wide range of other issues. The drafters were, to quote the preamble, "Persuaded that [concrete action for the introduction and pursuit of adequate science and technology policies] can considerably assist in the creation of those conditions, which encourage and assist indigenous capability to perform research and experimental development in an enhanced spirit of responsibility towards man and his environment". They thus sought to combine in one document considerations on science ethics and on science policies that sketch a strong framework to support science for society.

This background conviction explains the choice of subject matter and wording for the Recommendation. "The word 'status' as used in relation to scientific researchers signifies the standing or regard accorded them, as evidenced, first, by the level of appreciation both of the duties and responsibilities inherent in their function and of their competence in performing them, and, secondly, by the rights, working conditions, material assistance and moral support which they enjoy for the accomplishment of their task." (article 1(e)). Such structural features connect to science ethics as the institutional background that makes ethical science possible.

Another paragraph of the preamble makes this link very clear:

> "a) scientific discoveries and related technological developments and applications open up vast prospects for progress (…) but may, at the same time, entail certain dangers which constitute a threat especially in cases where the results of scientific research are used against mankind's vital interests (…) and in any event give rise to complex ethical and legal problems;
> b) to face this challenge, Member States should develop or devise machinery for the formulation and execution of adequate science and technology policies, that is to say, policies designed to avoid the possible dangers and fully realize and exploit the positive prospects inherent in such discoveries, technological developments and applications."

It seems reasonable, therefore, to interpret the Recommendation as a whole in an ethical light. Institutional matters such as working conditions (articles 20 and 21), professional training (article 22), mobility and career development (articles 23-25 and 28), social insurance (articles 29 and 30), evaluation (articles 32-34), and publication and intellectual property issues (articles 35-40), are not ethical in themselves, but they do provide an indispensable background for ethical behaviour.

Ethical science thus *requires* a certain mode of institutionalization of which professional, adequately trained, permanent and secure researchers are an essential component. It follows that monitoring the status of scientific researchers is not a task tangentially connected to ethics, and perhaps better conducted in an

alternative framework of assessment of national research systems, but on the contrary a core task of science ethics. Indeed, the weakness of a research system, in terms of the standard variables by which it can be characterized (policies, resources, scientific performance, response to social needs, interdisciplinary networking), may be expected to correlate strongly with the likelihood of unethical behaviour within it. Consistently with the perspective sketched in section 2 of this report, this entails a distinctive perspective on ethics. Ethical behaviour should not be seen as a form of "heroism", accessible only to people who are for whatever reason "virtuous". Rather ethics is something to be "routinized" by capacity building that embeds it in the ordinary institutional structures of science.

Conversely, the intimate link between science policy and science ethics precludes subjection of science to ethical perspectives not derived from the logic of science itself. The purpose of an ethical approach to science is not to block scientific progress or to regulate scientific activity but on the contrary to allow them fully to flourish.

Keeping in mind the general articulation between principles and institutions, the key substantive ethical principles of the Recommendation can be summarized quite simply. They converge on the responsibilities incumbent on researchers as a corollary of the status afforded to them. The word "responsibility" occurs on numerous occasions in the Recommendation, and refers to several separate but connected issues.

- Responsibility to ensure that science serves the interests of humanity as a whole: "the full potentialities of scientific and technological knowledge [should] be promptly geared to the benefit of all peoples" (article 19).
- Responsibility of scientists to conduct themselves in accordance with high ethical standards: "effective scientific research calls for scientific researchers of integrity and maturity, combining high moral and intellectual qualities" (article 10). The availability of such researchers in turn depends on effective education, training and wareness-raising at all levels.
- Responsibility to respect accountability to the public, as a corollary of enjoyment of "the degree of autonomy appropriate to their task and to the advancement of science and technology" (article 8).
- Generic requirement of humane, social and ecological responsibility in research conduct (article 14 as quoted above), "social" responsibility being interpreted in terms of service to one's own country (article 9(c)) and of "community service" (article 11(b)).
- Specific responsibility to be "vigilant" with respect to the "probable and possible social and ecological consequences of scientific research and experimental development activities" (article 12(b)(iv)).

In generic terms, these general statements about responsibility appear to have enduring relevance. Nonetheless it is important to note that the 1974 Recommendation is in some respects dated. Thus, the Recommendation takes for granted a primarily "public sector" framework for science[3] and assumes implicitly that the major threats from inappropriate scientific research or misuse of research results or scientific knowledge relate to the Cold War logic of the "arm's race". Conversely, major issues of contemporary concern are not explicitly dealt with, although they may of course be adequately covered by the general principles enshrined in the Recommendation. Such issues include the public

[3] Although article 2 does explicitly extend the scope of the Recommendation to all researchers, irrespective of employment status.

character of science, in terms of both the organization of its activities and access to its knowledge; post-Cold War security concerns; environmental threats; the relation of science to the dynamics of globalization; and the implications (especially ethical) of new forms of science and recent technological breakthroughs. In addition, contemporary concerns about gender inclusiveness are unsurprisingly absent from the text.

Of particular significance is the fact that, while the exclusive emphasis on public science may have been reasonable in 1974, not least in terms of defining the responsibilities that specifically belong to Member States, many contemporary concerns relate to scientific conduct regardless of its institutional setting, and therefore appear to call for a framework that is less oriented towards research policies, broadly understood, and more focused on individual scientists and scientific communities. If so, while Member States would undoubtedly continue to have a key regulatory role, not least via their science and technology policies, a broader perspective on "codes of conduct" for scientists might be required, taking account of the full range of voluntary and mandatory professionally enshrined mechanisms for ethical regulation.

As a result, there is a two-fold challenge. On the one hand, implementation of the 1974 Recommendation, with its limitations, must be monitored as effectively as possible, since it remains a highly relevant statement of the intimate link between science policies and science ethics and since its basic ethical principles have lost none of their validity. On the other hand, ongoing reflection is required to ensure that the general ethical framework to guide scientific activity – which should include but cannot be limited to the 1974 Recommendation – is kept up to date and constantly connected to the concrete exigencies of science.

### 1999 DECLARATION ON SCIENCE AND THE USES OF SCIENTIFIC KNOWLEDGE

Given its limitations and the need to reflect on its continuing relevance, the Recommendation should also be considered in light of the 1999 Budapest Declaration on Science and the Uses of Scientific Knowledge, first adopted by the World Science Congress and subsequently endorsed by the UNESCO General Conference, along with the Action Plan addressing broad science policy issues adopted at the same Conference.

It is important to note, however, that the Declaration does not have the same normative status as the Recommendation and does not currently command universal respect. Furthermore, the Declaration is neither an application, nor an extension, supplement or replacement, of the Recommendation, to which it makes no specific reference. Nonetheless, the existence of the two instruments entails that a connection be established between them.

The Declaration has a similar ethical orientation to the Recommendation. However, it is updated substantively to take account of new concerns, including specifically "the growing complexity of the relationship between society and its environment". In addition, it is unconnected to detailed institutional considerations, and it is premised upon a much broader understanding of the stakeholders of science. In addition, the Declaration addresses a number of issues outside the scope of ethics strictly understood that lacked prominence in 1974, such as globalization, the information and communication revolution, biodiversity and sustainability, gender balance, disadvantaged groups, and traditional and local knowledge systems.

The main ethical issues covered by the Declaration are as follows:

- science should be for the benefit of humanity as a whole (article 1) but, alongside its benefits, has led to "environmental degradation and technological disasters, and (…) contributed to social imbalance or exclusion";

- scientists have "a special responsibility for seeking to avert applications of science which are ethically wrong or have an adverse impact" (article 21) – a responsibility more specific and far-reaching than provided for in the Recommendation;

- a specific requirement is placed upon Member States to "establish suitable measures to address the ethics of the practice of science and of the use of scientific knowledge and its applications" (article 40), which goes beyond the background institutional framework of the Recommendation;

- "science curricula should include science ethics" (article 41), which reflects the emphasis in the Recommendation on education and training, but goes beyond it in giving "science ethics" intellectual autonomy as a sub-discipline, and not simply a topic.

### OTHER RELEVANT INTERNATIONAL NORMATIVE SOURCES

A number of international normative documents state principles of direct relevance to science ethics, although their specific subject matter may be different. Documents will be reviewed in order to identify principles that could contribute to the general ethical framework to guide scientific activity, with particular emphasis on areas such as bioethics and environmental ethics.

### OTHER RELEVANT SOURCES AT NATIONAL OR REGIONAL LEVEL

Numerous normative documents have been produced at national and regional level. It remains to be determined whether a review of national legislation, regulation, voluntary codes etc. is appropriate or useful for the purposes of COMEST's reflection on science ethics.

### OTHER RELEVANT SOURCES AT PROFESSIONAL OR INSTITUTIONAL LEVEL

Science ethics is extensively institutionalized within professional and institutional settings on which considerable information available (e.g. from the Global Ethics Observatory). It remains to be decided how far to go in describing or analyzing them for the purposes of this report.

### REVIEW OF PAST AND ONGOING COMEST WORK ON SCIENCE ETHICS

COMEST has, from its inception, been considering science ethics both in general and in specific areas.

Current work is set within UNESCO's strategy to address ethical issues relating to science and technology. The key strategic challenge in the current Medium-Term Strategy (2008-13) [4] is "to ensure the monitoring and analysis of the impact

[4] It should be noted that the Medium-Term Strategy covers all areas of ethics of science and technology and in particular makes no distinction between bioethics and other

of scientific and technological innovations on human rights through the strengthening of its action on the ethics of science and technology". The emphasis on human rights requires additional conceptual development, particularly with respect to the implications for science ethics of the right "to share in scientific advancement and its benefits" enshrined in the Universal Declaration of Human Rights (article 27(1)).

With this strategic challenge in mind, the key areas of work are defined as follows:

- "Establish and promote common values and benchmarks, as well as to promote ethical principles and standards to guide scientific progress and technological development, especially in developing countries that do not enjoy equal benefits of scientific and technological advances.
- Examine scientific progress in light of ethical considerations rooted in the cultural, legal, philosophical and religious heritage of the communities involved.
- Seek to create a better understanding of the major ethical issues raised by science and technology and support analysis and discussion of those issues internationally, regionally and nationally.
- Support the implementation and refinement of existing normative instruments, and the application of practices and tools to facilitate the growth and use of science and technology respecting human dignity and human rights.
- Support the development of new instruments as may be deemed necessary by the governing bodies.
- Promote ethical reflections and decision-making, including through international cooperation and the sharing of experience.
- Promote the application of the instruments and guidelines and strengthen their impact.
- Provide a forum for an interdisciplinary, multicultural and pluralistic reflection on new and emerging global issues, bringing together the intellectual and scientific communities, policy-makers, public and private stakeholders and actors of civil society.
- Establishment and reinforcement of national bodies and mechanisms of COMEST bodies.
- Involvement of society at large by raising awareness, undertaking advocacy and stimulating an open democratic debate about the ethical implications of scientific and technological developments and the link between ethics and governance.
- Ethics education for young scientists, professionals and trainers."

The UNESCO strategy does not constitute a restriction on the work of COMEST, which is empowered to advise the Director-General on any areas of ethics it may consider appropriate. The strategy does, on the other hand, indicate to COMEST the areas where its contribution to UNESCO's activities is particularly expected.

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areas. For programmatic purposes, however, bioethics is dealt with separately because of its uniquely well-developed normative basis. There are areas of intersection between bioethics and science ethics within the competence of COMEST (such as the regulation of conduct in the life sciences) but they do not extend to the substantive concerns of bioethics as enshrined, for instance, in the 2005 Universal Declaration on Bioethics and Human Rights.

Applied to science ethics, this strategic framework serves as a reminder of the necessary articulation between analysis of challenges, elaboration of principles, development of mechanisms, and awareness-raising, education and training.

The existing normative framework implies a pluralized and "distributed" model of ethics in which multiple sites with distinct logics combine to promote and entrench ethics at all levels of scientific conduct. The UNESCO Medium-Term Strategy explicitly reflects this multi-level approach to ethics, and effectively distinguishes six levels of ethical institutionalization, all of which are relevant to UNESCO although not all fall directly within the Organization's programmes:

- international normative standards and indicative ethical frameworks;
- national legislation and regulations;
- national ethics committees and similar bodies;
- institution-specific processes, including employment contracts and institutional ethics committees;
- ethics education and training, including the full range of awareness-raising activities;
- the various issues relating to dissemination and circulation of scientific information, including in particular the ethical aspects of publication.

It is important for COMEST to consider which levels of action should be emphasized, and which institutions should take responsibility for them.

With respect to past and current work, as well as possible future developments, the following specific areas (among others) deserve more detailed comment.

## CONSULTATIONS

In light of concerns about the substantive relevance and normative status of the 1974 Recommendation and 1999 Declaration, it might reasonably be considered whether the most appropriate institutional response would not be to develop a new, more comprehensive and fully up-to-date, but at the same time specifically ethical, normative instrument. The 2005 UNESCO General Conference did indeed request the Director-General to review this issue and report on the advisability of elaborating an "international declaration on science ethics" to serve as a basis for an "ethical code of conduct for scientists".

However, when the Director-General duly reported to the Executive Board in 2006, he concluded that adoption of a new normative instrument was not the most appropriate mechanism to take forward the ethical concerns expressed by Member States.

This conclusion, which the Executive Board endorsed, was based on a series of regional and national expert consultation meetings held in Krakow, Poland (March 2006), Tokyo, Japan (April 2006), New Delhi, India (April 2006), Geneva, Switzerland (May 2006), Bangkok, Thailand (May 2006), and Belo Horizonte, Brazil (May 2006).[5] The preliminary conclusions from the meetings had also been considered and endorsed by COMEST at its Extraordinary Session in June 2006 and Ordinary Session in Dakar, Senegal (December 2006).

[5] A further consultation meeting was held in Cairo, Egypt, in October 2008. Consistently with the results of the 2006 process, the meeting was invited to consider not adoption of a new normative instrument but monitoring of the implementation of the 1974 Recommendation and its place within a general ethical framework to guide scientific activity.

Rather than development of a new normative instrument, UNESCO was therefore invited to work towards a general ethical framework to guide scientific activity on the basis of the Executive Board decision quoted in section 1. The existing normative instruments constitute an important component of this prospective ethical framework.

In parallel with promotion and monitoring of the implementation of the 1974 Recommendation, taking account of the 1999 Declaration, additional developments are envisaged.

The issue is less to develop *an* "ethical code of conduct for scientists" (in the singular) than to develop appropriate (plural) ethical standards and mechanisms for the regulation of scientific conduct with due regard to the diversity of (national, disciplinary, etc.) situations and to the fact that not all regulation is or should be within the competence of Member States. The emphasis on a participatory process involving scientific communities and other stakeholders follows directly from this requirement. One implication is that State-level monitoring of implementation would be inadequate if not supplemented by monitoring at a more general level of the multiple processes by which ethical principles for science are institutionalized. There is a place for regulation as for exhortation, for labour contracts as for professional standards, for national uniformity as for institutional specificity.

## ETHICAL PRINCIPLES FOR SCIENTIFIC CONDUCT IN SPECIFIC AREAS

In addition to activities relating to science ethics in general, COMEST is also engaged in activities focused on ethical issues in specific areas, defined by particular issues (e.g. nano-ethics, environmental ethics) or specific notions (e.g. the precautionary principle).

Nanotechnologies are currently of particular concern in this respect. On the one hand, the field is still in its early stage of development and COMEST has the opportunity to be prospective and anticipatory in identifying ethical issues that may emerge. On the other hand, the impact of nanotechnologies is global. As industrial and commercial development proceeds, the focus is gradually moving from possible technological futures, with a view to better understanding of the scientific potential and possible societal impact of new developments, to the regulation of conduct in areas of science where cutting-edge agendas are already being pursued. Thus, to take just one interesting example, the European Commission Recommendation on a Code of Conduct for Responsible Nanosciences and Nanotechnologies Research[6] specifically calls upon research funding agencies to refrain from funding research in certain supposedly problematic areas and, explicitly or implicitly, calls upon "responsible" researchers to abstain from engaging in such research. This exemplifies the connection between ethical concerns about science and technology and science ethics in the strict sense.

In its previous phase, the work of COMEST emphasized state-of-the-art review and conceptual development, [7] awareness-raising [8] and reflection on policy implications. [9] Noting that the invisibility and rapid development of

[6] Adopted in February 2008. EC Document C(2008) 424 final.
[7] Henk T.A.M. ten Have (ed.), *Nanotechnologies, Ethics and Politics*. UNESCO Publishing, 2007.
[8] *Ethics and Politics of Nanotechnology*. UNESCO, 2006.
[9] *Nanotechnologies and Ethics: Policies and Actions*. UNESCO, 2007.

nanotechnologies, their possible military and security uses and global impact, and the risk of a "nano-divide" between the developing and developed countries, give rise to specific ethical concerns, COMEST pointed to four areas of action: articulating an ethical framework, awareness raising, ethics education, and research and development policies. Nanotechnologies should be regarded, in this respect, not as a *sui generis* area calling for development of an *ad hoc* ethical framework, but rather as one set of issues to which a general ethical framework to guide scientific activity needs to apply. Conversely, science ethics principles developed to address specific features of nanotechnologies should be considered as *prima facie* applicable to other areas with similar background features.

The current work of COMEST focuses on achieving take-up of the 2007 policy recommendations both at the policy level and within academic and scientific communities. Scientific conduct is by no means the only issue in this regard, but it is one important dimension of the ongoing ethical conversation.[10]

### RESEARCH INTEGRITY

The existing normative framework for science ethics takes it for granted that the integrity of science is a condition for it to contribute to human wellbeing, and therefore also a condition for scientists to enjoy the status accorded to them by the 1974 Recommendation. The fact that integrity may be violated – and indeed that current conditions may make violations more likely – is well identified (see sections 2.2 and 2.3). A full response to this challenge needs to combine education, training and awareness-raising with effective procedures to detect, investigate and punish serious cases of scientific misconduct. Current work focuses on the latter objective.

In the framework of the OECD Global Science Forum, UNESCO is contributing to global reflection on misconduct in international research and on the institutional mechanisms that might facilitate effective prevention, detection and investigation of falsification, fabrication and plagiarism. Work in this area responds to two related integrity concerns: first that international research cooperation makes it easier for research misconduct to pass unnoticed, even when adequate mechanisms exist at the national level; and secondly that the context of international research, including new commercial and/or security pressures on institutions and individuals, makes research misconduct more likely to occur, as indeed may also be the case at national level. The work of the OECD Global Science Forum is preparatory, inter alia, to the Second World Congress on Scientific Integrity, currently planned for 2010. Parallel work is under way, again with UNESCO participation and with many of the same stakeholders, in the context of the European Science Foundation Member Forum.

### GLOBAL ETHICS OBSERVATORY

Efforts continue to collect and survey codes of scientific conduct produced by bodies or institutions, whether public or private, with relevant mandates. The objective of the survey is to develop more systematic knowledge about the kinds of instruments that are judged most appropriate for specific circumstances and to

[10] Among specific activities, it should be noted that COMEST has been closely involved with UNESCO activities on ethics of nanotechnologies in the Arab region. An international expert meeting held in Doha, Qatar, in May 2009, led to a consensus that a declaration on the ethics of nanotechnologies would be valuable, certainly at regional and possibly at international level, and that UNESCO, with the advice of COMEST, should start work towards such a declaration.

make a strong knowledge base available through the online Global Ethics Observatory (GEObs) to all interested stakeholders.

### BIOSECURITY

Scientific and technological transformations within the life sciences, along with new concerns about the use of biological knowledge and technologies, have stimulated major international interest in “biosecurity”, one component of which is the perceived importance of appropriate forms of regulation of scientific conduct and of the circulation of scientific information. At the invitation of the World Health Organization, of the Biological Weapons Convention, and of national partners such as the US National Academies of Science, UNESCO has been actively involved in preliminary discussion about identification of issues and of steps that might be required.

### THE HUMAN RIGHT TO SHARE IN SCIENTIFIC ADVANCEMENT AND ITS BENEFITS

Among the human rights within UNESCO’s competence, emphasis is currently being put on the underdeveloped right “to share in scientific advancement and its benefits”, of which the ethical corollary is the obligations incumbent on scientists to ensure that their work serves the universal benefit of mankind and to make it available to appropriate audiences in relevant ways.

**Recommendations [PRELIMINARY PROPOSALS FROM WORKING GROUP]**

**MONITORING OF IMPLEMENTATION OF THE 1974 RECOMMENDATION**

- The monitoring process should be designed so as to ensure integration of science ethics and science policy issues. It should also give Member States the opportunity to comment on the limitations of the Recommendation and the practical steps that might be taken to supplement it, *inter alia* through enhanced articulation with the 1999 Declaration.
- In addition to monitoring of national policies, consideration should be given to the impact of globalization, with particular reference to fair employment and non-employment conditions *across* and *within* national research systems.
- Particular attention should be given in analysis and follow-up of the monitoring process to global inequalities including brain drain and inequitable distribution of research funds.
- The role of public investment in research leading to public benefit should be promoted. Public-private partnerships, where relevant, should be equitable with regard to sharing of costs and benefits.

**ACTION REQUIRED TO FOLLOW UP THE 1999 DECLARATION**

[No specific proposals formulated to date.]

**DEVELOPMENT OF ETHICAL CODES OF CONDUCT**

- The ethical principles developed for States and other institutions in the existing normative framework should be extended in a coherent fashion to individual researchers and corporate scientists.
- Steps should be taken to establish cooperation with relevant national, regional and professional bodies in order to explore pluralistic options for development of a general ethical framework to guide ethical activity.
- Analysis of existing codes of conduct should proceed with a view to developing a knowledge base to inform discussion among relevant stakeholders at all appropriate levels.

**OTHER DESIRABLE DEVELOPMENTS**

- An initiative would be desirable to promote international collaboration aiming at improvement of benefit sharing, particularly directed at developing countries that currently have inadequate access to scientific and technological advances.
- UNESCO is invited to bring together scientific editors and publishers to consider issues of access to scientific information and publication-related misconduct, including not just falsification, fabrication and plagiarism, but also premature release of sometimes exaggerated results without adequate peer-review (whether for professional or commercial gain) and the availability of harmful information on the Internet. Collaboration with SciDev could be one practical step in this regard.
- A review should be conducted of intellectual property issues relevant to science ethics, with a view to assessing whether any gaps remain

to be filled that should be brought to the attention of the appropriate bodies.

- Coordination between COMEST and the International Bioethics Committee should be improved, particularly with regard to areas of overlap such as biotechnologies and technological convergence. The possibility of a joint meeting or joint working group should be considered.

**FUTURE DIRECTIONS FOR COMEST WORK ON SCIENCE ETHICS**

- COMEST should engage in reflection on the tools and practical modalities that might make it possible to establish a forum for interdisciplinary, multicultural and pluralistic reflection on new and emerging global issues, bringing together the intellectual and scientific communities, policy-makers, public and private stakeholders and actors of civil society.
- COMEST should seek to encourage dialogue on shared ethical principles between experts from diverse cultural, legal, philosophical and religious backgrounds.
- COMEST should engage in reflection on the application of the language of risk and uncertainty to scientific and technological issues that have been framed by the existing normative framework in terms of “dangers”, taking account of and extending its previous work on the precautionary principle, with the objective of clarifying the “vigilance” required of scientists with respect to possible misuse of science.
- COMEST should explore the relevance of a review of science ethics teaching.