Position Paper On Access To Databases

Prepared by the ICSU/CODATA Group on Data and Information

The International Council of Scientific Unions (ICSU) was created in 1931 to promote international scientific activities in all areas of natural science and their applications for the benefit of humanity. More than 135 nations adhere to ICSU or its scientific unions. Since its creation, a major objective of ICSU has been to assure that scientists in all nations can obtain access to data and other types of technical information that are essential to their work.

ICSU and its member organizations have become increasingly concerned about the recent proposals pending before WIPO and some national legislatures to introduce a new form of sui generis intellectual property protection for the contents of databases, which would fall outside the traditional patent and copyright regimes. Because of this concern, ICSU and its Committee on Data for Science and Technology (CODATA) have jointly created a Group on Data and Information. This document has been prepared by, and represents the views of the Group.

The Group believes that the sui generis database proposals, if adopted, would have deleterious effects on the progress of science and on the translation of scientific advances into new technology and enhanced economic development. The Group recognizes that the threat of piracy could become a potential disincentive to the creation of new value-added scientific databases. However, the proposed solutions to a problem that has not even been clearly identified would have a serious negative impact on science and on society at large. This paper explains the basis of the concerns of the ICSU/CODATA Group and presents examples of the importance of open access to information needed for scientific purposes.

The paper is organized as follows:

I. Principles for the conduct of science

Scientists are both users and producers of databases. However, scientific databases are seldom static; in the course of their research, scientists frequently draw on several existing databases from which they create a new database that is tailored to their specific research objectives. The synthesis of data from different sources in order to provide new insights and advance our understanding of nature is an essential part of the scientific process. The history of science is rich with examples of data collections which played a crucial part in a scientific revolution that in turn had a major impact on human society. It may truly be said that data are the lifeblood of science.

The following set of broad principles for the conduct of science is an attempt to provide standards against which organizations and individuals can evaluate legislative proposals that affect the use of scientific databases. Several examples of the application of these principles are given in the scenarios in the Annex.

- Science is an investment in the public interest. Through research and education, scientists foster the creation and dissemination of knowledge, which has profound effects on the well being of people and the economies of the world. Science is increasingly being recognized as a critical public investment in our future, a resource with extraordinary dividends.
- Scientific advances rely on full and open access to data. Both science and the public are well served by a system of scholarly research and communication that moves rapidly and openly with minimal constraints on the availability of data for further analysis. The tradition of full and open access to data has led to breakthroughs in scientific understanding, as well as to downstream economic and public policy benefits. The idea that an individual or organization can control access to or claim ownership of the facts of nature is anathema to science.
- A market model for access to data and other technical information is unsuitable for scientific research and education. Science is a cooperative, rather than a competitive, enterprise. No individual, institution, or country can collect all the data it needs to address important scientific issues. Thus, practices that encourage data sharing are necessary to advance many fields of science and to achieve the resulting social benefits. Such data sharing is possible only when the data are affordable within tight research budgets. If data are formally made available for scientific access, but the prices charged for such access are prohibitively high, the negative impact on science is the same as if access had been legally denied. This is especially the case for scientists in developing countries.
- Publication of data is essential to scientific research and the dissemination of knowledge. The credibility of research depends on the publication of the data that back up the conclusions from the research and permit reproduction of the results by colleagues. Any restriction on data publication or any requirement that the database be recompiled from original sources for validation purposes compromises the ability of scientists to advance knowledge.
- The interests of database owners must be balanced with society's need for the full and open exchange of ideas. Given the substantial investment in data collection and its importance to society, it is equally important that data are used to the maximum extent possible. Data that were collected for a variety of purposes—basic research, environmental monitoring, industrial R&D, etc.—are useful to science, so legal foundations and societal attitudes should foster an appropriate balance between individual rights to data and the public good of shared information.

It follows that, when legislators consider enacting intellectual property laws to promote investment in the compilation of databases, they must take into account the potential impact such laws may have on science and education in general and on the complex worldwide network through which scientific data are currently exchanged in particular. The guiding principle should be that any domestic or international initiative in this direction should leave science and education in no worse a condition than they were in prior to its adoption.

II. Legal and economic issues concerning database protection

1. Nature of the problem

The copyright laws of most developed countries already protect original and creative compilations of data, and Article 10(2) of the Agreement on Trade-Related Aspects of Intellectual Property Rights of 1994 ("TRIPS Agreement") mandates such protection in some 131 countries that belong to the World Trade Organization ("WTO"). These copyright laws normally contain long-established exceptions and limitations favoring science and education, which, though varying from one jurisdiction to another, have proved workable over time. Most copyright laws also limit the compilers' scope of protection to original and creative elements of selection or arrangement, which are treated as a form of literary "expression," but do not protect data as such, which are treated as unprotected building blocks of knowledge, like ideas and discoveries. This limitation is expressly recognized in Article 10(2) of the TRIPS Agreement. Copyright laws thus generally do not prevent third parties from reusing or extracting data from a given compilation, even when the particular selection criterion or arrangement of the compilation remains protected, and the incentives these laws provide to motivate the compilers' and publishers' investment of time and effort have not so far unduly burdened scientific and educational pursuits. However, because copyright laws traditionally apply only to "intellectual creations" (in the EU) or to "original and creative works of authorship" (in the U.S.), their applicability to broadly comprehensive electronic databases that include all relevant data (so that selection criteria are not at issue) has been questioned.

For example, the U.S. Supreme Court, in Feist Publications, Inc. v. Rural Telephone Service Co. ("Feist")[1], denied copyright protection to the white-page listings of a telephone directory on the grounds that they contained no creative selection or arrangement, and the implications of this decision have echoed around the world. In particular, it has generated fears that computerized databases and other electronic information tools that result from the convergence of digital and telecommunications technologies might fall into a gap between the domestic copyright and patent laws, which could leave compilers and investors vulnerable to unbridled copying or "free riding" by users and by would-be competitors alike. If this perceived vulnerability were to undermine incentives to invest in the compilation and dissemination of electronic databases, it could thwart development of new markets for electronic information tools.

To avoid these risks, the European Union recently adopted Directive 96/9/EC of the European Parliament and of the Council [of Ministers] of 11 March 1996 on the Legal Protection of Databases ("EU Directive on Databases").[2] This Directive requires each of the EU's Member States to enact laws giving database makers a hybrid (or "sui generis") exclusive property right in the contents of all databases that fail to qualify for copyright protection under their domestic copyright laws. The new sui generis right directly protects investors as such (i.e., not authors or creators) against unauthorized acts of "extraction and/or reutilization of the whole or of a substantial part, evaluated qualitatively and/or quantitatively of the contents of … [their] databases," for an initial period of at least fifteen years.[3] Any compiler who makes further investments in the database may continually renew that right for additional fifteen-year terms without limit, in which case the compiler's exclusive (and potentially perpetual) right covers the database as a whole, and not just the added matter.[4]

The Directive mandates a broad scope of protection for qualifying investors, whose sui generis "extraction right" covers even temporary transfers to online receivers and whose "reutilization right" covers online use or transmissions of data, including those in value-adding or derivative formats.[5] At the same time, the Directive confers virtually no exceptions or limitations other than the right of lawful users to extract or reutilize "insubstantial parts of the database." Even insubstantial parts cannot be extracted in "repeated and systematic" ways that "conflict with a normal exploitation of that database or … [that] unreasonably prejudice the legitimate interests of the maker,"[6] a condition that some commentators believe "could preclude most value-adding uses of an insubstantial part of the database, regardless of their commercial or noncommercial purposes."[7] Otherwise, the Directive mandates no exceptions or limitations favoring scientific and educational activities, although it allows each member state, at its option, to authorize extraction of a substantial part of a noncopyrightable database "for the purposes of illustration for teaching or scientific research, as long as the source is indicated and to the extent justified by the noncommercial purpose to be achieved." This exception applies only to "extractions" by "lawful users" who presumably have already paid for access to the database for the aforementioned purposes, and not to reutilization.[8]

This EU Directive, which extends to all present and would-be affiliates of the European Union, denies similar protection to database makers whose countries of origin have not reciprocally enacted an equivalent sui generis intellectual property right in the contents of noncopyrightable databases.[9] This recourse to material reciprocity (rather than the rule of national treatment that the TRIPS Agreement universally mandates for preexisting intellectual property laws) threatens to create artificial and potentially grave impediments to the full and open flow of scientific and other data across national frontiers, at a time when networked systems of telecommunications had otherwise promised to render transborder flows of data virtually frictionless.[10] The resulting tensions have led to proposals for a new international intellectual property treaty to protect the contents of noncopyrightable databases,[11] and this topic will be explored at a World Intellectual Property Organization (WIPO) meeting of experts and concerned parties, to be held in Geneva, Switzerland, on 17-19 September 1997.

ICSU contends that the EU Directive represents an unwise and unjustified response to the problem outlined above, one which was based on insufficient study of the relevant empirical and economic data. ICSU further contends that implementation or emulation of a sui generis exclusive property right in the contents of databases along the lines of the EU Directive could irreparably disrupt the full and open flow of scientific data which ICSU has long labored to achieve, and that it could otherwise seriously compromise the worldwide scientific and educational missions of its member bodies and agencies. In this paper, ICSU has accordingly sought to acquaint the delegations to the WIPO conference and other concerned parties with the growing body of evidence that supports the following conclusions:

- There is, in fact, no gap in the law and no failure of incentives that would justify enacting a new exclusive property right in the contents of databases.
- If such a gap or failure of incentives should materialize in the future, other, socially more desirable means of dealing with it are available in domestic laws.
- Even if these socially more desirable alternatives were to be adopted, special care must be taken to promote the public interest in science, education, and research libraries and to ensure that these institutions are left in no worse a position than they occupied before any such remedial action was taken.
- No new international treaty regulating intellectual property rights in the contents of databases should be proposed or adopted without serious, sustained, and impartial study of all its potential effects. As stakeholders in the information economy, the worldwide scientific and educational communities should participate fully in the relevant deliberations.

- Any proposed treaty must respect the special needs of the developing and least-developed countries, which look to the acquisition of scientific and technical knowledge as the foundation of their future economic progress.
- If further studies eventually lead to a consensus concerning the need for international action to protect the contents of databases, any such action should be premised upon a cautious, minimalist approach that leaves maximum flexibility to each participating state.

In the following sections, we seek briefly to explain and support these conclusions.

2. The need for a new intellectual property right has not been demonstrated

Neither the European Union nor the World Intellectual Property Organization ever commissioned an impartial legal and economic study to demonstrate the shortcomings of existing laws pertaining to investments in databases. In the absence of such a study, self-serving assertions that investors are deterred by a perceived lack of incentives remain anecdotal and unsubstantiated, and they ignore the arsenal of legal and technical measures currently available to data vendors. In fact, the rapid growth in the past few years of electronic databases of all kinds, including hundreds aimed at the scientific market,[12] hardly suggests a lack of incentives.

Copyright laws still cover the bulk of all factual compilations and databases, because only a minimum quantum of selection or arrangement is required to qualify under these laws; thus they suffice to protect most investors against wholesale copying for the purpose of developing a competing product. Under the proposed sui generis regime, database providers would be able to cumulate copyright with sui generis protection in order to protect the data in perpetuity.

To the extent that copyright law fails to protect the contents of any given database, contract and unfair competition laws provide additional layers of protection. Access to all databases transmitted via the Internet or other telecommunications networks is already subject to the contractual conditions of the providers, as is the distribution of data via CD-ROMs. As regards online bibliographic databases covering papers in scientific journals and other such dynamic databases, which are updated on a continuing basis, the provider can simply deny copiers further access to them. Because the value of these databases derives primarily from their being up-to-date, denial of access will quickly reduce the value of an old database in the customer's possession.

Moreover, contract law has been reinforced by self-help technical measures, such as encryption devices, technical brakes on downloading, and electronic "tagging," which provide database makers with formidable weapons to protect their investments against free-riding appropriations of the data they compile. These technological measures are expected to become even more powerful in the future.

In the event that copyrights, contracts, and self-help technical devices failed to repress wholesale copying—a remote possibility, in our view—the unfair competition laws already extant in most countries would suffice to interdict parasitical or market-destroying business practices. The fact that courts have shown a willingness to apply unfair competition law in appropriate cases indicates a viable alternative to heavy-handed intellectual property legislation.[13]

Given this arsenal of weapons, there appears to be no basis for claiming that would-be investors in database production face an imminent loss of incentives, and there is no evidence that free-riders have actually deterred such investments. The proponents of a sui generis regime have not supplied even anecdotal evidence of database publishers whose product development was deterred by inadequate intellectual property protection. Even in the U.S. Supreme Court's famous Feist decision, which supposedly opened a gap in the law, the defendant's victory resulted partly from the plaintiff's refusal to license a value-adding use, despite the plaintiff's own monopolistic position. The Supreme Court viewed value-adding uses of disparate data as pro-competitive and socially useful pursuits, which even copyright law—when applicable—should not disrupt. In other words, the defendant was not a free-rider, and the plaintiff's lack of royalties resulted from its own refusal to deal.

It does not seem wise to proceed further with untried and socially costly forms of legislative relief for a problem whose existence has not been demonstrated. On the contrary, contract law—in combination with encryption devices and other technology—now appears to provide such a formidable means of regulating the flow of data that there is, if anything, a need to relax the oppressive terms and conditions that some online data providers have contractually imposed upon educational and research libraries.

3. The risk of monopoly pricing and other constraints on the exchange of data

A recent study by the U.S. National Research Council stresses the extent to which the existing market for scientific and technical databases is characterized by natural monopolies and by a distinct lack of competition.[14] Under present-day conditions, the costs of entry are typically so high, while the niche market segments on which commercial exploitation becomes feasible are typically so small, that sole-source providers are the norm. Moreover, in the case of databases of observed values of time-dependent (or one-time) natural phenomena, such as sun spot cycles or earthquakes, the data are inherently unique, so that it is impossible to recreate the database.

If investment in databases lags behind some hypothetically desirable but still unattained level, despite the arsenal of existing legal and technical protective measures identified above, the reason is that user markets remain small in relation to the high costs of entry. A new exclusive property right will not increase the size of those markets and may actually decrease overall investment by impeding value-adding uses and by erecting otherwise insuperable barriers to entry.[15]

Many of the most widely used scientific databases are sole-source and government-funded to boot. "In some cases, the (public good) scientific research is tightly tied to the collection, manufacture, and distribution of the data generated from the research," as for example the Hubble Space Telescope projects, while in other, often overlapping cases, "the contributors of scientific data are the same as the consumers of the data, all of whom are members of the same relatively small research community."[16] Consequently, the market model is likely to prove "not only. . . countercultural, but also counterproductive," with the result being "that the data either would not be provided by the market or would be provided under monopoly conditions."[17]

Against this background, a theoretical possibility for second comers to independently create a database from scratch is often economically unfeasible in practice. In addition, the observations of interest to science may not be repeatable or the relevant data may be proprietary to begin with. Even when independent creation becomes feasible, reinventing the wheel is not consistent with either the norms of science or of market economics.[18] Rather, science builds cumulatively upon its preceding contributions, and any legal solution that compelled the scientific community to recompile data from scratch would be misguided.

Because most databases are either natural monopolies or intrinsically defended by high barriers to entry, implanting a strong exclusive property right into this environment will tend to produce an absolute legal barrier to entry. This, in turn, facilitates monopoly pricing and fosters a substantial risk that big commercial providers will gradually control the building blocks of knowledge. Under these circumstances, the potential harm to the scientific enterprise is enormous. Basic science needs abundant, unrestricted flows of both raw and evaluated data at prices it can accommodate within the present severely restricted research budgets. Indeed, the evidence suggests that "efficient" use of data is a concept antithetical to the norms and practice of basic science.[19] On the contrary, by using all available data in ways that encourage serendipity and imaginative exploration, basic science arrives at precisely those breakthroughs that lead to technical applications later on.[20] When, instead, data become too expensive, scientific research is retarded. We see a concrete example of these principles in the failed attempt by the U.S. Government to privatize *Landsat* data in the 1980's, which raised the price of data sets from $400 to $4400 per image and set back important research areas for many years.[21]

At the very least, complicated licensing transactions that would undoubtedly arise if protection is extended to the contents of scientific databases will deter and diminish the transborder flow of data that ICSU and its affiliates have painstakingly negotiated over the years. This will hinder scientists seeking to construct ad hoc databases from disparate sources in order to attack major societal problems such as global climate change. Pressures will also be exerted against the sharing ethos and against the principle of full and open access to data in general. Because scientific databases are worldwide in scope, the problem of integrated data sets from different sources will become acute over time if some are protected and others are not, and these complications will worsen if the norms of science themselves change in response to the advent of proprietary rights in data.

In sum, if databases that are now freely available fall under sui generis exclusive property rights, the cost of research will inevitably rise and much less of it will be successfully undertaken. Moreover, the culture of science, which presupposes the sharing of data among institutions, will also change, as these institutions begin to treat their own databases as profit centers. All business and government agencies that conduct or depend on research will be adversely affected in the end, whatever their expectations of short-term gain at the moment.

4. The EU Directive is not a suitable model

The scientific community does not condone free-riding and does not oppose reasonable measures to encourage investment in the compilation of commercial databases, if a demonstrable need should arise. However, we do believe that investment should not result in "ownership" of data discovered in nature or in the power to exercise an exclusive property right in the building blocks of knowledge. We, therefore, oppose efforts to internationalize the EU's sui generis database law. This law posits an exclusive property rights model that is paradoxically stronger than the mature copyright paradigm itself and that also lacks the kind of public-interest safeguards and limitations that are built into the "cultural bargain" underlying the copyright paradigm.[22] The EU Directive[23] and, implicitly, the proposals made to WIPO in 1996, which are based on that model, have many troublesome features:

- The creation of an absolute exclusive property right in the contents of databases;
- Reliance on a very broad and inclusive definition of databases that potentially includes every information product that has heretofore been freely available from the public domain;
- The introduction of long and potentially perpetual terms of protection based on unlimited renewal rights in a database as a whole whenever updates are added to it;
- No evolving public domain from which previously compiled data could ever freely be used;
- No public-interest limitations of any consequence for the preservation of public-good activities, such as research, education, and libraries;

- No mandatory legal licenses or other limitations requiring sole-source providers to make data available on reasonable terms and conditions, with due regard for the preservation of competition and the public interest in research and education;
- Such a broad and pervasive concept of use or extraction of a substantial part of a protected database as to vitiate the one exception that nominally allows use of insubstantial parts of that same database;
- No preservation of value-adding or transformative user rights either in the same or distant markets;
- The introduction of strong civil (and, possibly, even criminal) remedies for infringement that could have a chilling effect on the principle of full and open exchange of scientific data.

The end result is a blueprint for an extremely restrictive intellectual property right, one that will become engrafted upon the natural monopolies that already characterize the market for databases and which could lead to effective ownership of the building blocks of knowledge.

If data piracy should empirically become more of a problem than it has proved to be so far, then the appropriate remedy is to attack piratical conduct as such, mainly by means of unfair competition law. That was the principle with which the European Union began its efforts in this field.[24] If more refined efforts to correlate reasonable royalties from certain value-adding uses with the freedom to use data for such purposes seem desirable, then WIPO should study recent proposals for a modified liability regime to this effect.[25]

Therefore, ICSU feels that there should be no presumption that the EU's sui generis database regime is the appropriate model to follow. On the contrary, the evidence suggests that the EU Directive is a product of inadequate theoretical and empirical study, that it contains serious technical and conceptual flaws, and that it is economically unsound. It is also worth noting that another EU Directive, i.e., the Council Directive on the Freedom of Access to Information on the Environment,[26] requires that relevant data collected by public authorities must be provided at a reasonable cost to users, and that provisions of the EU Directive on Databases may be inconsistent with this requirement. Until these issues are properly evaluated, the rest of the world cannot allow the European Union to dictate the intellectual property options available to other sovereign states.

In sum, we agree that courts and legislatures may legitimately repress certain uses of data when these uses amount to parasitical or predatory forms of competition that inhibit investment in the compilation of commercial databases. If and when it is shown that more is needed, we could support minimalist, pro-competitive efforts to interdict parasitical copying, but we cannot support the imposition of an exclusive property right on data.

5. Preserving the public-good uses of data

If circumstances were to justify international action to protect the contents of databases (and even if such action were rooted in unfair competition law rather than an exclusive property right), the relevant international and national laws should provide measures to safeguard the scientific and educational communities' ability to obtain access to both publicly and privately funded data on reasonable terms and conditions. This need has, of course, already arisen in the European Union, where the EU Directive allows member states the option of enacting exceptions to, and limitations on, the new sui generis right that favor teaching and scientific research.[27] ICSU urges the EU and affiliated governments to implement such exceptions broadly, with due regard for the principle of full and open access to data generated with public funds, and it hopes that the European Union will encourage the member governments in this respect.

Implementing appropriate exceptions and limitations will require careful distinctions between uses that are “free” and those that providers must permit, but on fair and reasonable terms and conditions.[28] Beyond these technical considerations, the scientific and educational communities need:

- Access to data on reasonable terms;
- The ability to use the data thus accessed for any research or educational purposes;
- Freedom from contractual or technical interference with these privileges.

A bedrock principle should require that whenever a given database is substantially funded by government and made available to the public, such data should always be accessible to the scientific and educational communities at the cost of fulfilling the user’s request (i.e., the marginal cost of reproduction and dissemination). This same principle should apply even when the database is partly or insubstantially funded by the private sector, as might occur with regard to private sector dissemination of government data, irrespective of the prices that providers and distributors may charge other users for other purposes; in other words, data generated by public funds and made available to the public should come freighted with a built-in, cost-based discount for science and education as a condition of their further commercialization by others.

Conversely, when the private sector or other nongovernmental entities fund the generation or distribution of data that are made available to the public, the ability of scientists and educators to gain access to those data for public-good activities remains indispensable,[29] even if a different calculus of rights and duties is required. Here the problem is that the ability of science and education to pay the going, commercial rates is not commensurate with their resources or with the public interest in a strong basic scientific and educational establishment. The solution is not to shunt the problems of science onto publishers, but to ensure that publishers who benefit from legal protection of their databases charge scientific and educational users fair and reasonable prices that take account of the overriding public interests at stake.

When, accordingly, data not funded by government are made available to the public under any domestic law that protects investments in databases (including unfair competition laws or variants thereof), that law should preclude the provider from denying access on preferential terms to the data for research or educational purposes. The law could also require that researchers and educators who thus invoke a legal license to obtain privately funded data should pay equitable compensation for these uses. In putting forward these constructive proposals for balancing the interests of private data vendors with those of the research, educational, and library communities, ICSU does not concede the propriety of enacting exclusive property rights in data—i.e., in the building blocks of knowledge in an Information Age. This is not a concession that science and education are prepared to make, nor is it one that can easily be reconciled with either freedom of speech or with traditional principles of intellectual property law. On the contrary, we wish to reiterate what we earlier affirmed to be the single most basic proposition for the WIPO inquiry getting underway, namely, that all data—including scientific data—should not be subject to exclusive property rights on public policy grounds.

6. Action on an international treaty is premature

The foregoing discussion reveals the extent to which sui generis database protection remains untried and untested even in the European Union, whose member states have yet to implement the EU Directive of 1996. Furthermore, the need for such regimes has yet to be demonstrated in the rest of the world. There is, accordingly, no solid foundation for adopting an international treaty concerning the legal protection of non-copyrightable databases, because treaties governing international intellectual property rights require a consensus about needs and modalities that will take years, if not decades, to form.

In the meantime, the most appropriate action for WIPO is to undertake a serious, impartial, broad-ranging study of the issues, without any preconceptions or biases with regard to any particular set of proposals or solutions. The scientific and educational communities should participate fully in these deliberations, along with all other stakeholders whose interests might be affected by an international treaty to encourage investment in databases.

As regards the argument that the reciprocity clause of the EU Directive requires action at the international level, it should be understood that many—if not most—of the Continental European countries have fallback laws (especially unfair competition laws) that could prevent free-riding duplication of the contents of databases; access to these laws by foreign vendors cannot be denied under the national treatment and MFN clauses of the TRIPS Agreement. Moreover, there is reason to question the compatibility of the EU's reciprocity clause with the now universal norm of national treatment under the Paris, Berne, and TRIPS Agreements, and with Article XX of the GATT component of the WTO Agreement itself, which forbids use of intellectual property laws to create disguised barriers to trade. This tension would become especially acute if other countries rejected the EU's exclusive rights model and insisted on more pro-competitive approaches and on national treatment. In this uncertain state of affairs, the EU should not vex comity among states by declining to protect foreign data vendors under its Directive, and its failure to exercise restraint would almost certainly trigger retaliation by other states.

If, after thoroughgoing study, it should eventually appear that some international action to deter the wholesale copying of the contents of databases were still needed, then a cautious and minimalist treaty to prevent piratical conduct by specified means could be considered. In that event, the Convention for the Protection of Producers of Phonograms Against Unauthorized Duplication of their Phonograms of October 29, 1971 ("Geneva Phonograms Convention") might provide a suitable model. That Convention leaves the mode of implementation up to the contracting states and allows them to choose from a menu of legal options that include "protection by means of the grant of a copyright or other specific right; protection by means of the law relating to unfair competition; protection by means of penal sanction."[30] Such an approach would not oblige any country or group of countries to adopt any particular antipiracy law, so long as some effective antipiracy regime were set in place.

III. Special needs of the developing countries

Among the factors that can significantly affect the powers of the least-developed and developing countries to overcome technological lag and other economic disadvantages is the growing potential for rapid international diffusion of scientific and technical knowledge. Because their national systems of innovation are still in the process of formation, there is reason to hope that these countries can rapidly accommodate new information technologies in ways that accelerate leapfrogging, reduce path dependence, and overcome technological "lock out." "Measures that increase the relevant local communities' direct access to the world's cumulative store of technical knowledge in the cheapest, most efficient manner are thus of primary concern in any effort to boost national competitiveness."[31]

In this context, one cannot overemphasize the extent to which the knowledge needed to embark on specific technological paradigms tends, in its early phases, to be public knowledge, often generated by universities and research institutes. Public investment in both the infrastructure for accessing foreign technical knowledge and in higher education are thus critical components of an appropriate institutional framework for catching up and leapfrogging. Assuming that a developing country can muster the investment needed to establish adequate telecommunications infrastructures, it can accelerate the transplanting of know-how from more industrialized countries through electronic transmittal and storage of technical information.[32]

The advent of the Internet as a low-cost method of conveying digital information could thus make specialized, heretofore path-dependent know-how universally accessible. To the extent that basic science lends itself to industrial applications, electronic databases can facilitate its translation into new technologies everywhere, so long as the receivers are otherwise capable of absorbing the data and of defraying their cost. Developing countries should thus "strive to fashion a legal framework that enhances the flow of information along telecommunications networks and that otherwise accelerates the transfer of know-how."[33]

Proposals to encumber the full and open access to scientific and technical data by means of a sui generis exclusive property right in the contents of databases would severely compromise these prospects for more rapid economic growth in the developing countries.[34] Such laws would, at the very least, increase the costs of acquiring data and of conducting research at the very time when developing countries must spend huge sums to adapt their own institutional framework to the changing universe of digital communications networks and to provide their local scientific and technical communities with the equipment to access available resources. At worst, such laws would balkanize the transborder flow of data and restore the conditions in which technological lockout previously flourished.

The developing countries are, moreover, already subject to considerable economic and political strains due to the need to enhance their existing intellectual property systems in order to comply with the high international minimum standards that the TRIPS Agreement of 1994 mandates for all WTO member countries. There is no reason for these countries to assume additional intellectual property burdens without countervailing trade concessions, especially when such new burdens could compromise their ability to access needed scientific and technical data.

Many developing countries in the ICSU family believe that an international treaty such as that under consideration by WIPO is an anti-science move, designed with a subtle intent to weaken the growth of science and innovation in the less-developed world, and as a serious threat to the integrity of science. They would see the treaty as symptomatic of an emerging trend to exploit their vulnerability in terms of preparedness level and affordability.

IV. Conclusions and Recommendations

ICSU believes that the need for sui generis legislative action to protect the contents of databases has not been demonstrated at either the national or international levels, and the burden of proof lies on those who claim existing laws are inadequate. Furthermore, new legal and technical developments that strengthen the capacity of existing laws to prevent parasitical and predatory forms of competition should be carefully evaluated and encouraged before introducing a radical new protection paradigm.

Legal restrictions on the full and open exchange of data inherently conflict with freedom of speech, and the imposition of exclusive property rights on data would seem to encounter insuperable constitutional impediments in some countries, such as the United States, as well as fundamental public policy objections in all countries. Developing countries, in particular, have much to lose and nothing to gain from such initiatives.

Nothing prevents courts, administrators, and legislators from devising reasonable constraints on free-riding conduct that destroys the incentive to invest in the compilation and dissemination of databases, and efforts to inhibit parasitical or predatory copying as such merit further study. This approach does not require either an exclusive property right or any legal definition of databases, and it avoids the imposition of legal monopolies in a market whose structure already lends itself to natural monopolies rather than a competitive framework.

In this connection, any legislative action at either the national or international levels should be demonstrably pro-competitive in effect, and should contain built-in measures to avoid abuse without the need to invoke antitrust or ancillary remedies. Care must also be taken to preserve adequate incentives for follow-on innovation and transformative uses of data in both the commercial and noncommercial spheres of activity.

If additional international regulation of databases becomes necessary, then it should be premised upon a minimalist approach that affords the maximum flexibility for each member state to address parasitical copying by means that are consistent with its own legal and economic policies. In all such cases, appropriate exceptions and limitations must be devised to maintain the full and open flow of data and information to the research, educational, and library communities and to ensure that these communities are left in no worse condition than they were in before any such action was taken. Moreover, such exceptions should not expose these ongoing public-good activities to the vagaries of case-by-case decisions, and must instead stabilize and institutionalize long-term practices of price discrimination and product differentiation. The difficulties of identifying and implementing a suitable balance between incentives to invest and the preservation of both free competition and essential public-good uses should not be underestimated, nor should legislation be rushed before a full understanding of the consequences is reached.

Annex. Scenarios illustrating the impact of the proposals on various fields of science

Example 1. Mapping the ocean floor

How often do we need a map to find a point of interest, to navigate on a trip, as a base reference for locating mineral deposits, or to describe the shape of the Earth's surface? At the end of the 20th century we tend to take accurate maps for granted, but beneath most of the ocean they do not exist—an unfortunate reality for scientists, oil prospectors, deep-sea explorers, and submarine commanders. Until recently the surveys necessary to produce a topographic map of the depth of the ocean floor have required countless days of echo-sounding from expensive ships. Even the combined efforts of many nations have provided only a rough outline of the mountains and plains, continental slopes, and deep trenches which underlie the ocean. Fortunately, many such shipboard surveys also measured simultaneously the local variations in the strength of gravity, which is the precise weight of a standard object on board a ship.

Earth-orbiting satellites have been mapping the average shape of the ocean surface relative to the center of the Earth with an uncertainty of no more than a centimeter. The details of this shape depend upon local gravity, which in turn depends upon the topography of the sea floor beneath.

Recent declassification of this satellite data by the U.S. Department of Defense has opened up a new way to map the ocean floor at a spatial resolution that was previously unattainable. Scientists have done so by combining the newly available data with the historical archive of echo-sounder and gravity surveys by ships from 42 institutions in 18 countries. The resulting topographic maps are being used for navigation, recreation, exploration of ocean minerals, and location of fisheries.

This example illustrates how advances in science often depend upon the open publication and unrestricted sharing of high-quality data, which are then combined in ways that were not envisaged at the time the data were collected.

Example 2: Predicting future climate based on the past

To understand how human activities affect the global environment, we also need to examine how climate can change due to natural causes. Even though the burning of fossil fuel and conversion of wilderness areas for agricultural or urban use has greatly modified our current environment, records of past environments still exist, locked in layers of ice and rock. Piecing together these fragmentary records of the past and incorporating that information into computer models that predict the future environment permits decision-makers to make more informed choices.

Scientists from around the world are cooperating to compile a database on the environment. The database includes estimates of temperature, rainfall, lake levels, and vegetation for different environments during the past few ten thousand years. Most such estimates are based upon indirect indicators; for example, temperature can be estimated from the relative concentration of different types of oxygen within the ice sheet over Greenland, and vegetation cover can be estimated from the grains of pollen in the layers of sediment at the bottom of a lake. The data sets are produced by individual scientists working at universities around the world, making measurements in the field, analyzing samples in the laboratory, and testing inferences against the critical scrutiny of colleagues. After the scientists publish their conclusions, the underlying data are compiled to form a picture of what the Earth was like in the past, and are freely distributed worldwide by the ICSU World Data Center for Paleoclimatology.

Full and open sharing of information is essential to such collaborations. They depend upon mutual understanding that the relevant data are common property, not to be withheld for private gain or competitive advantage. Having the first opportunity to interpret data is what motivates much of its collection. The right of an individual to intellectual property in those data is indeed recognized through that first opportunity, but in practice it is limited voluntarily because the community benefits by being able to build a larger picture.

A scientist producing a compilation has to inspire the trust of his or her colleagues in several ways: first, that the result is likely to be important; second, that appropriate attribution will be given to their contributions; and third, that all scientists will have access. Shared ideals and peer pressure are the incentives. Self interest and restrictive attitudes toward data sharing in the broader society are the obstacles. This example illustrates that the balance between individual rights to data and the public good of shared information is a delicate one, and that legal foundations and societal attitudes which foster such a balance are critical to important scientific enterprises.

Example 3: Publishing global-change data: *Trends '93*

In 1994, ICSU's World Data Center for Atmospheric Trace Gases published *Trends '93: A Compendium of Data on Global Change*. The publication, which compiles data provided by 139 individuals in 13 countries, is a key source of data on global warming and other changes in our global environment. It includes data on climate, the concentrations of atmospheric gases, and the consumption of fossil fuels and other aspects of carbon use, most of which were originally collected using public funds.

The popularity and utility of this publication has been immense. Since 1994, *Trends '93* has been requested by over 13,000 individuals, libraries, and agencies and has been cited approximately 80 times in the scientific literature. It was also referenced several times in the Intergovernmental Panel on Climate Change's recent assessment, *Climate Change 1995*, which was commissioned by the United Nations and the World Meteorological Organization to provide a factual basis for policy decisions by nations on a key environmental issue. It took several years to identify, obtain, and synthesize data from such diverse sources. If legislation conferring sui generis property rights for databases had been in force, the World Data Center might have had to: obtain intellectual property rights releases from all contributing individuals and institutions; write the report differently to conform with the laws of 13 countries; and publish statements to the effect that there were no non-acknowledged contributors to their data that might later claim intellectual property rights. In such a case, it is almost certain that *Trends '93* would not exist.

This example illustrates how, under a property rights regime that does not adequately provide for the needs of database users as well as for the rights of database compilers, it could become impossible for governments to obtain the information needed to address key scientific and policy issues.

Example 4: Measuring the state of the ocean

Two thirds of the world is covered by ocean, and conditions there have a profound influence on weather and climate, as well as on fisheries, shipping, and the spread of pollutants from disasters such as the wreck of the *Exxon Valdez*. No single country can gather all the oceanographic data it needs. As a result, since the beginnings of modern oceanography around 1900, data collected by research vessels, collaborating merchant ships, and national navies have been freely exchanged and archived at international data centers. Even during the Cold War, substantial amounts of data were passed between East and West. Though some governments now restrict information about their exclusive economic zones, exchanges relevant to the open ocean are increasing.

All of the international oceanographic data centers contain substantial amounts of data collected by scientists from around the world. For example, approximately 75% of the digital oceanographic data archived at ICSU's World Data Center for Oceanography are from other countries. These historical environmental data are priceless in the sense that we cannot go back in time to sample again. Thus, if prospective changes in the regime of property rights surrounding databases are not handled appropriately, countries risk losing access to foreign oceanographic data of considerable value. Those submitting foreign data will not want their data captured in a restricted database not under their control, nor will they want to see private firms benefiting unreasonably from their national data archives. Data flow would be reduced so both operational prediction and more basic research would suffer.

The ethic of full and open access to data has greatly enhanced the value of databases used by oceanographers. This situation could be jeopardized under a more restrictive property rights regime.

Example 5: Producing convenient reference books

Most data involved in the fields of physics, chemistry, and material science are numerical values of some property of a specified substance, material, or system of interacting substances. The data originate from measurements taken in individual laboratories—ranging from small chemical laboratories to large particle accelerators—and they are disseminated through research papers in scientific journals and government reports. Over half a million research papers are published annually in the field of chemistry alone, and a substantial fraction of these contain data of potential interest.

Even before the end of the nineteenth century, this body of research had grown so large that it was difficult and time-consuming to locate previously published data. This led to the international practice of compiling data from the primary literature and republishing in handbook format. Early examples include the *Landolt-Bornstein Tables of Numerical Data and Functional Relationships in Science and Technology*, the *Beilstein Handbook of Organic Chemistry* (both of which began in the nineteenth century), and the *International Critical Tables*, a seven-volume set of data books prepared through an international effort in the 1920's. Such compilations have made a major contribution to the progress of science and technology, and thousands of data books and review articles are in use today. Many have been converted into electronic databases; in fact, the transition from the printed handbook to the searchable database is well along.

Although works of this type generally qualify for copyright protection, someone wishing to produce a new compilation aimed at a specific application can take data from existing handbooks, as well as from the original scientific literature, arrange the data in a form appropriate to the new application, and publish the new work—even if the individual numbers have all been extracted from other sources. This process is universally accepted as beneficial to science and engineering. Hundreds of compilations, ranging from a few pages to multiple volumes, appear each year. In fact, a few journals, such as the *Journal of Physical and Chemical Reference Data*, are devoted exclusively to compilations.

The fear of unauthorized reproduction or extraction has not inhibited the creation of valuable new compilations in physics, chemistry, and material science. Although the creator/owner of a useful physical science database would enjoy additional protection under a sui generis regime, he would find it far more difficult and expensive to create his product. The development of a single database of modest size might require thousands of letters to obtain permission from (and possibly pay fees to) the owner of every database (scientific journal or other compilation) from which numbers are taken. The disincentive produced by this requirement would far outweigh the incentive resulting from the additional layer of protection for the fruits of one's labor—a layer whose need is not apparent to current producers of databases.

Example 6: Improving industrial efficiency

Modern industrial practices rest increasingly on a sound understanding of underlying scientific principles. Few industrial processes today rely on a trial-and-error approach; instead, sophisticated computer models based upon established scientific theories are involved in the design, operation, and control of every step of the process. From the design of more efficient air conditioners to the creation of exotic new materials to the development of new energy sources, science plays a major role.

The computer models used in these varied applications generally require vast amounts of data. Some of these data have applications to many different industrial problems, so great efficiencies can be achieved by developing publicly available databases. For example, a consortium of chemical and oil companies established the Design Institute for Physical Property Data in the early 1980's to build databases of chemical properties. Participating companies use a polling procedure to choose the chemicals and the data are extracted from published sources and formatted for use in computer models and process design calculations. Participating companies get exclusive use of each new edition of the database for a short initial period, after which the database enters the public domain.

Similarly, the International Alloy Phase Diagram Program has enlisted experts on metals and alloys from many parts of the world to create a comprehensive database on phase diagrams—a type of road map to the behavior of two metals when they are mixed. These diagrams are fundamental to the design of new alloys and to the prediction of the performance of structural alloys under various conditions. The resulting database, derived from data in thousands of research papers and reports, is widely used in many industries for a variety of purposes, including efforts to develop substitute materials that are safer and require less energy to produce.

These examples illustrate the need for cooperation and data sharing in industries with a strong scientific base. Such industries rely on the principle that fundamental facts of nature, such as the properties of materials, should be available for use for the common good. Legal steps that threaten this principle will impede the preparation of databases aimed at improving industrial efficiency and speeding economic development.

Example 7: Identifying chemical substances

Chemical analysis—the identification of specific chemical compounds and determination of the amounts present—is a ubiquitous technique in the modern industrial world. It plays an essential role in almost all manufacturing industries, all aspects of energy production, the development and regulation of drugs and, of particular importance, environmental protection and worker safety. The myriad governmental regulations designed to limit exposure of the public to harmful chemicals would be meaningless without the ability to measure these substances in water, air, and soil. Numerous analytical techniques have been developed over the last 40 years, spawning a multi-billion dollar industry in the manufacture of instruments for chemical analysis.

Most of these instruments operate by measuring a highly specific "signature" for each chemical substance. The signature is then compared with a library of such signatures to determine what chemicals are present and in what quantities. Today the measurements are generally made automatically and the comparison is done by computer programs that can identify the signatures of individual chemicals in a complex mixture. The database that serves as the library of signatures is the most critical link in the process. Consequently, many such databases have been developed, some involving several hundred thousand chemicals, and others including only the chemical signatures needed for a particular application. Since requirements tend to change continually, updating, modifying, or creating the databases is a dynamic process.

Most databases for chemical analysis are produced by compiling data from scientific journals and reports, assessing the quality of the data, and arranging them in a standard format. The level of authority assigned by users to a particular database is determined primarily by the scientific judgment of the compilers, who select the data in which they have the most confidence. If legal restrictions were to be introduced that inhibited the compilers from extracting data from certain sources without the onerous task of obtaining permission from the original publisher or author (and possibly paying a fee), many scientists would be reluctant to get involved in what is already a tedious job with limited rewards in terms of professional advancement. A new disincentive would undoubtedly reduce the availability of vitally needed databases for chemical analysis.

Example 8: Mapping the genome

The DNA in living organisms (the genome) is the inherited substance that contains all the information required to specify an individual, whether it be a bacterium or a human being. Genetic information resides in the sequence of the nucleotide building blocks of the DNA molecules. The operationally effective substances are the proteins, whose chemical structures are encoded in the DNA blueprint, but whose 3-dimensional shapes are responsible for their functional properties. Understanding these properties and applying this understanding to the design of novel pharmaceutical products, for example, has led to the biotechnology revolution.

The acquisition of new data has accelerated greatly as a result of international collaborative projects and the custom that the results be freely exchanged. As a result, the complete DNA sequence of yeast is now known and the determination of the entire human genome is advancing rapidly. Molecular biologists have created a hierarchy of databases. At the basic level are several independent databases of protein and nucleic acid sequences. The protein sequences are deposited directly into the databases. The coordinates of atoms obtained by 3-d structure analysis of macromolecules are published in scientific journals, which typically require deposition of coordinates as a condition of publication. By general agreement of the practitioners in the field, all macromolecular coordinates are deposited in a single internationally-monitored databank, maintained at the Brookhaven National Laboratory.

Derived value-added databases have also been developed, including databases combining the information in the primary databanks and sequence/structure databases in which proteins are classified according to structural or functional characteristics, enabling functional and evolutionary relationships to be deduced. Such classifications are important, for example in designing antibacterial compounds that must specifically attack an infective organism with minimal effect on the host. Both primary and derived databases are generally in the public domain, along with software for extraction and interrogation, via the Internet.

Results are deposited for free exchange. Continued open access to the databases is therefore essential for workers in the field. Molecular biologists, on obtaining new information, now invariably scan the databases and extract and use data on similar or related substances. Any withdrawal or significant restriction on availability of these databases would bring current research virtually to a halt, both in fundamental studies and in applications in the pharmaceutical, agrochemicals, medical diagnostic, food, and biotechnology industries.

Example 9: Indexing the world's organisms

Despite the widespread use and exploitation of organisms, growing concern about the loss of biodiversity, and the need for conservation of genetic resources, there is no modern, unified inventory of the estimated 1.75 million species of the world. Such an inventory is difficult to produce because many organisms still lack formal scientific names or are known by different names in different regions. To provide unique and accessible names for the world's known plants, botanical and information specialists from around the world have formed the collaborative International Organization for Plant Information (IOPI).

IOPI's long-term objective is to establish, through a network of integrated, dispersed, electronic databases, a comprehensive summary of the basic taxonomic information, biological attributes and potential for utilization of all plant species, and to make these data accessible in various ways to a diversity of users. The first phase of this worldwide plant information system is the creation of the *Global Plant Checklist*, a botanical database which includes taxonomic, descriptive, biological, ecological, and molecular information. When complete, the *Checklist* will provide the much needed reliable, master inventory of plant species of the world (estimated at 300,000 species of vascular plants) for the diverse users of plants or their products.

International collaboration and decentralization are key elements of the *Checklist* project. So far specialists from 27 institutions in 14 countries have contributed to the *Checklist*, and many other botanical specialists have been contacted to participate in the near future. The actual *Checklist* database is held in Berlin, but the entire database is available on-line.

This example shows the importance of international collaboration and the free exchange of data among the world's biologists. New restrictions on the compilation (or recompilation) of data could jeopardize the creation of valuable international databases like the *Global Plant Checklist* and similar projects with other major groups of organisms.

Footnotes

1 499 U.S. 340, 359-60 (1991).

2 1996 O.J. (L77) 20.

3 EU Directive, *supra* note 2, arts. 1(1), 7(1).

4 *Id*., art. 7(2).

5 *Id*., art. 7(1)(a), (b).

6 *Id*., art. 8(1). However, member states may allow "extraction for private purposes of the contents of a *nonelectronic database*." Id. art. 9(1) (emphasis added).

7 J. H. Reichman & Pamela Samuelson, *Intellectual Property Rights in Data?*, 50 Vanderbilt L. Rev. 51, 91 (1997).

8 EU Directive, *supra* note 2, arts. 9, 9 (b).

9 *Id*., art. 11.

10 *See generally* NATIONAL RESEARCH COUNCIL (USA), BITS OF POWER: ISSUES IN GLOBAL ACCESS TO SCIENTIFIC DATA, chs. 2, 4, 5 (1997) (report prepared under auspices of the U.S. National Committee for the Committee on Data for Science and Technology (CODATA)) [hereinafter BITS OF POWER].

11 *See* Basic Proposal for the Substantive Provisions of the Treaty on Intellectual Property in Respect of Databases, Memorandum Prepared by the Chairman of the Committee of Experts, August 30, 1996 ("WIPO Draft Database Treaty") and submitted to the Diplomatic Conference on Certain Copyright and Neighboring Rights Questions, Geneva, Switzerland, Dec. 2-20, 1996, WIPO Doc. CRNR/DC/6 (August 30, 1996). The Conference postponed action on this proposal.

12 To give one example from the field of chemistry, most of the classic chemical data books, some of which have been continuously updated for more than a century, have already been converted to electronic form and are distributed for profit in online or CD ROM format. Examples are the *Beilstein Handbook of Organic Chemistry, Gmelin Handbook of Inorganic Chemistry, Chapman&Hall Dictionary of Organic Compounds, CRC Handbook of Data on Organic Compounds, The Merck Index*, etc. Extensive lists of chemistry resources on the Internet can be found at <http://www.chemweb.com>, <http://www.indiana.edu/~cheminfo/>, <http://www.rcpinc.com>, <http://www.tds-tds.com>, and <http://www.intraaccess.com/fdm>.

13 Even in the United States, whose unfair competition law is less developed in this regard than those of most continental European countries, recent federal appellate decisions provide database makers with powerful legal weapons against free-riding appropriations of the fruits of their investments. In *NBA v. Motorola*, 1997 U.S. App. Lexis 1527 (2d. Cir., Jan 30, 1997), for example, a panel of the United States Court of Appeals for the Second Circuit found that state law sounding in the misappropriation branch of unfair competition law could prevent market-destructive or parasitical uses of another's compilation if and when specified economic criteria indicative of a potential market failure were satisfied. Furthermore, free riders usually have not prevailed in United States courts, even though the courts lack any sui generis regime to fall back upon and are traditionally sensitive to the needs of competitors. Indeed, in the one major case where a free-rider might have disrupted a socially useful, two-tiered chain of distribution that distinguished between commercial and noncommercial users, the United States Court of Appeals for the Seventh Circuit upheld a "shrink-wrap" license that prohibited this "leakage" and that reinforced the database maker's own encryption measures. *See ProCD, Inc. v. Zeidenberg*, 86 F. 3d 1447 (7th Cir. 1996). To this same end, the United States Uniform Law Commissioners are about to promulgate a Draft Article 2B of the Uniform Commercial Code covering contractual licensing of intangible assets, which would reportedly support generalized enforcement of licenses like that upheld by the Seventh Circuit.

14 *See* BITS OF POWER, *supra* note 10, Ch. 4 ("Data from Publicly-Funded Research—The Economic Perspective") and Ch. 5 ("The Trend Toward Strengthened Intellectual Property Rights: A Potential Threat to Public-Good Uses of Scientific Data").

15 Under these conditions, "when privatization or commercialization [of data] lead to unregulated monopoly supply," the report finds "it is not good public policy, and especially not good for science." BITS OF POWER, *supra* note 10, at 124..

16 *Id*., at 113.

17 *Id*.

18 For these and other reasons, the European Union had consistently insisted on subjecting all sole-source data providers to a nonvoluntary license, which would have required them to make data available on reasonable terms and conditions; but at the last minute, the Council of Ministers inexplicably withdrew this provision from the final version of the EU's new Directive on the Legal Protection of Databases. *See* Reichman & Samuelson, *supra* note 7, at 84-95.

19 *See*, *e.g*, BITS OF POWER, *supra* note 10, at ch. 4.

20 *See id*. This type of exploration is an important component of the "progress of science," which intellectual property law supposedly promotes.

21 *See*, *e.g*, BITS OF POWER, *supra* note 10, at ch. 4, Boxes 4.3 and 4.4 ("The Failed Privatization of Landsat" and "The Impact of Landsat Privatization on Research," respectively).

22 *See* Peter A. Jaszi, "*Goodbye to All That—A Reluctant (and Perhaps Premature) Adieu to a Constitutionally-Grounded Discourse of Public Interest in Copyright Law*", 29 Vanderbilt J. Trans. Nat'l. L. 595, 599-600 (1996). *See also* BITS OF POWER, *supra* note 10, at 145 to 161; Reichman & Samuelson, *supra* note 7, at 72-113.

23 *See supra* note 2.

24 *See* Reichman & Samuelson, *supra* note 7, at 80-85. *See also* paper presented by Prof. Willem Groscheider, Mullengraff Institute, Utrecht, the Netherlands, to the Fifth Annual Fordham Conference on International Intellectual Property Law and Policy, April 1997 (criticizing exclusive property rights approach).

25 *See* Reichman & Samuelson, *supra* note 7, at 145-51 ("A Modified Liability Approach"). *See generally*, J. H. Reichman, *Legal Hybrids Between the Patent and Copyright Paradigms*, 94 Columbia L. Rev. 2432, 2504-2557.

26 EU Directive 90/313/EEC, 7 June 1990, O.J. No. L 158, p. 56, vol. 1990, 23 June 1990.

27 *See* EU Directive, *supra* note 2, art. 9, 9(b).

28 For example, scientists must freely be able to use the data underlying existing scientific theories to verify or challenge those theories and to develop new ones. Similarly, researchers should have completely free use of their own data files in the conduct of their subsequent investigations, regardless of whether these files have been submitted for publication in electronic or print media. By the same token, no intellectual property law should ever prevent a scientist from reproducing or using an insubstantial part of the contents of a database for any purpose whatsoever. In these and other cases, the public interest in scientific progress should outweigh all other considerations.

29 *See*, *e.g*., Robert M. White [president emeritus of the National Academy of Engineering], TECHNOLOGY REVIEW (May/June 1997), at 65. *See also* Letter to the Secretary of Commerce from the Presidents of the National Academy of Sciences, the National Academy of Engineering, and the National Institute of Medicine (Oct. 9, 1996) ["Academy Presidents Letter"].

30 Geneva Phonograms Convention of 1971, art. 3.

31 J. H. Reichman, *From Free Riders to Fair Followers*: *Global Competition Under the TRIPS Agreement*, NYU J. Int'l L. & Politics (forthcoming 1997).

32 *See*, *e.g*., Luc Soete, *Opportunities for and Limitations to Technological Leapfrogging, in* TECHNOLOGY, TRADE POLICY AND THE URUGUAY ROUND, U.N. CONFERENCE ON TRADE AND DEVELOPMENT, UNCTAD/ITP/23, at 3 (1990); Cristiano Antonelli, *The Economic Theory of Information Networks, in* THE ECONOMICS OF INFORMATION NETWORKS 3, 5-6 (C. Antonelli ed. 1992).

33 Reichman, *From Free-Riders to Fair Followers*, *supra* note 31.

34 *See* G. Thyagarajan, *A Threat to the Integrity of Science*, The Hindu, 11 July, 1997.