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Foreword

In honor of the Bicentennial of the United States Constitution, OTA has undertaken a study of *Science, Technology, and the Constitution in an Information Age.* The project was requested by the Committee on the Judiciary of the House of Representatives and its Subcommittee on Courts, Civil Liberties, and the Administration of Justice.

Science and technology have, throughout our history, been major factors in shaping American society and our way of life. By changing the ways in which we interact with one another, science and technology often affect the way in which we define the general welfare, the way in which we view the realm of government, and the nature of the rights we exercise as American citizens. As we enter our third century of constitutional history, several areas of technology are undergoing rapid development and promise to have especially profound effects; microelectronics, biology, and chemistry, for example, are transforming the practice of medicine, criminal justice, newsgathering, and other social activities and institutions.

This background paper summarizes and discusses major themes that are being explored in the project on *Science, Technology, and the Constitution.* Several special reports on these themes are scheduled for release later this year.

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Contents

Page

The Centrality of Information. 2

The Principles of Constitutional Governance 4
- National Sovereignty 4
- A Democratic Republic. 5
- Federalism 8
- Separation of Powers 9

The Bill of Rights and Civil War Amendments 10
- The First Amendment 10
- Freedom of the Electronic Press 11
- The Fourth Amendment 12
- The Fifth, Sixth, and Eighth Amendments 14
- Other Amendments. 16
- Equal Protection 16
- Use Process of Law. 17
- The Penumbra of Privacy 17

Conclusion 19

Acknowledgments. *20*

SCIENCE, TECHNOLOGY, AND THE CONSTITUTION

The centrality of science and technology to American society argues that Congress and the courts will repeatedly be asked to reexamine constitutional principles in the context of new scientific knowledge and new technical capabilities. This paper seeks to stimulate continuing public discussion of the relationships between science, technology, and basic constitutional provisions.

The United States Constitution is entering its third century as our Nation's basic political and legal framework. It has guided our development as a democratic, free society for ZOO years during which both the economy and science have flourished. It has not only proven resilient to dramatic changes accompanying the industrial revolution and the development of modern telecommunications and transportation systems; it has also created a structure in which the scientific and technological ingenuity of the American people continues to flourish.

The pace of scientific and technological progress is relentless, offering us powers not dreamed of in 1787. Day by day, scientific research reveals more of the universe beyond the earth, the universe within the atom, and that further universe of possibilities within the human gene and the human brain. Technology gives us the tools to explore these frontiers, allowing us to modify not just our environment, as man has always done, but the human body, behavior, brain and the whole of our genetic heritage on a scale that is unprecedented. We can manipulate chemical factors in human behavior, measure human abilities, and predict human performance with increasing power and precision. With chemical and biological tests, we can both detect past behaviors and assess future risks to specific people from disease, pollutants, or their own genetic inheritance.

The social sciences also are improving our ability to monitor, predict, and modify human behavior and attitudes. We use the techniques of statistical analysis, modeling, simulation, and expert systems to decide who goes to prison and who is released, who exercises parental rights, who gets into college or a prestigious profession, and who gets a new heart.

We can intervene at the boundaries of life and death. Indeed, because of medical technology we have been forced to reconsider the definition of both. Advances in these technologies are insistently raising questions about the right to die; the sometimes conflicting rights of mothers and unborn children; and the right to impose the consequences of those decisions on parents, families, friends, and society at large.

Power, scale, precision, invasiveness, pervasiveness, persistence, and imperfection—these are inescapable characteristics of late 20th century technology. Nearly all facets of our life, including our work, play, homes, and health, are strongly affected by technology. Our economic strength and our national security depend on our continuing to be among the leaders in science and technology.

How will these world-shaking advances in human knowledge and capability change the context in which the Constitution's enduring principles of democratic governance and individual liberty operate? Can we look to the world of 2087 with confidence that the Constitution will meet the challenges of its third century and will continue to be a strong bulwark against abuse of both political and technological power? These are the questions examined in a series of OTA reports on science, technology, and the Constitution. These reports begin with the observation that we are moving into an era in which information, in all of its varied forms, has become the agent of vast social and scientific change.

THE CENTRALITY OF INFORMATION

Is technology changing what can be said to be a "reasonable expectation of privacy?"

A central theme in all areas of science and technology is radical improvement in our ability to gather, store, combine, and use information—especially information about people. This improvement is the result of continuing progress in such diverse fields of inquiry as computer science, molecular biology, chemistry, and cognitive psychology. In some cases, this new ability to gather and use information raises troubling questions about the scope and protection of that sphere of personal autonomy and privacy that the Founding Fathers could assume was beyond the effective reach of the state.

Electronic surveillance, for instance, is dramatically shrinking the locations and activities in which one has a recognized expectation of privacy. Techniques that derive information from an individual's body fluids, body structure, mental habits, voice timbre, eye motions, temperature change, and scores of other noncontrollable attributes generate knowledge about past behavior, allow monitoring and measurement of present activities, and may make possible predictions about future performance. We can electronically monitor criminals, or persons awaiting trial, in their homes. We can call up information about one person from a multitude of government or commercial databases, compare and integrate it and, in effect, reveal new information about that person without their knowledge.

There are bright promises and troubling uncertainties about established, emerging, or potential technical capabilities. But difficult questions may also be raised by the information or power that science cannot yet provide. For example, science can reveal and measure some threats that it cannot remove. It can tell us who has been exposed to the deadly HIV virus that causes AIDS, but not as yet how to remove the infection or cure the disease. Such questions as whom to test and how to use the results of testing create real tensions between the constitutional imperatives of individual rights and the general welfare.

Science can also reveal the presence of environmental toxins at ever lower levels, but cannot tell us whether the risks outweigh the benefits of which they are a byproduct. That judgment involves values and choices about which science has little useful to say. Here too the question of how to translate available scientific information into public policy involves important tensions to which the Constitution speaks.

Is "blacklisting" by means of computerized government information systems constitutional?

While information has immense benefits and capabilities to improve our lives both individually and as a Nation, it also has dangers. Information about a person is potentially a means of influencing and controlling that person. Information challenges traditional sources of authority and institutions built on that authority. Experience, training, and education may be rendered useless by new information. Information can also erode responsibility: what was once considered a sin to be condemned or a crime to be punished may, with fuller knowledge, appear to some as an illness to be treated or a genetic defect to be repaired. This perception can lead to imposingly difficult questions about the limits on social engineering in the context of constitutional values of personal freedom and privacy.

It is for these reasons that information, and the electronic, chemical, biological, and social technologies that generate and give access to it, often affect constitutional relationships that

we are accustomed to think of as political, economic, or legal in nature. Constitutional relationships deal with power, with limitations on power, and with the balance between them. Directly or indirectly, information often generates that power, informs its limitations, or affects their proper balance.

THE PRINCIPLES OF CONSTITUTIONAL GOVERNANCE

The seven Articles of the Constitution rest on a few fundamental principles of governance that were created and tested through centuries of struggle in the countries of Europe and in the American colonies. As articulated in the Constitution, these principles have proven robust enough to provide for order and social stability, yet capable of considerable flexibility and responsiveness in a changing society. The fundamental principles of constitutional governance include the concepts of national sovereignty, limited government, democratic representation, federalism with reserved State powers, and separation of powers within the three branches of the national government.

Each of these principles is affected by modern technology. National sovereignty is fundamentally challenged by the effects of extensive international transactions and transborder data flows, and by the necessity of multinational cooperation to cope with environmental problems related to technology. The structure of the relationships between elected representatives and their constituents, the various interest groups, and the other branches of government has been substantively changed by the use of communications and information technologies. Federalism continues to change as effects of technologies continually override jurisdictional boundaries. Cooperation in using databases and communications systems could erode some of the checks and balances protecting separation of powers.

National Sovereignty

Sovereignty may be defined as the exclusive and supreme control by a government over its territory and inhabitants. Under the Constitution, sovereignty in the United States is shared between the State and Federal Governments. The powers of the Federal Government are primarily those "necessary and proper' to carry out the functions listed in Article I, section 8. Under the 10th Amendment, the remainder of the power that can be exercised by government is reserved to the States.

Do powerful translational businesses, using global networks, make the concept of "national sovereignty" obsolete?

Since the mid-1800s, the scale of technology and the scope of its impacts have changed American life; first in transportation systems (e.g., the railroad), then in manufacturing and production (the steel industry, the automobile industry), and in communications systems (telegraph and telephone lines, radio, television). A concomitant broadening of the role of Federal Government and diminution of the autonomy of State governments in controlling technology has occurred in each instance. Federal power was used first to build and regulate national transportation and communications systems, then to protect health, safety, and employee welfare as manufacturing and commerce have matured. Federal power has been used to recover economic stability during the economic crisis of the 1930s, to set up a complex social security system, to deal with global wars, to put men on the moon.

Just as the development of a national transportation and communications infrastructure in past centuries expanded the Federal Government role in local and State affairs, technology is today expanding the theater of commerce and politics to global dimensions. In the process, it is diminishing the degree to which any nation, including the United States, may act as an autonomous sovereign.

Today, large-scale enterprises and the consequences of industrialization continue to force issues from the local to the national to the international level. Global communications networks are contracting the Federal Government's power by interlocking national economies, facilitating transnational business, and increasing the necessity of political and economic cooperation among nations. The world-

wide nature of today's technology-oriented problems, such as pollution of air and water, depletion of natural resources, global drug traffic, and intercontinental weaponry, all combine to force cooperative actions in the international arena and surrender of some national sovereignty.

The evolution of the translational corporation over the last 20 years illustrates the shift of power away from sovereign nations that accompanies global technology. Transnational enterprise is subtly but significantly different from the post-World War II multinational corporation that was or is still essentially based in and identified with one country —i.e., an "American multinational." New transportation and communications technologies, including high-speed air travel, bulk shipping facilities, flexible manufacturing and automation, distributed data processing and communications capabilities, and high-speed transmission of information, have allowed transnational corporations to shift operations between countries, depending on contingencies such as labor costs, availability of resources, and the political and economic climate of their host nation. These developments have increased the power of the transnational corporation, as economies of scale have allowed the internationalization and vertical integration of their markets.

Deregulation of the international monetary system, rapid movement of investment funds around the world, the trading of stock on foreign exchanges, and international corporate ownership and mergers make transnational businesses even more independent of national policies. In addition, the exchange of television shows, movies, fashions, music, and other forms of entertainment tends to homogenize cultures and consumer demand throughout the world, and could erode national loyalties and dependencies.

These developments parallel the rise of national corporations during the 19th and early 20th centuries, which brought about the expansion of Federal power and the resulting shift from the private power of corporations to the public power of the Federal Government. The internationalization of economic power may now be causing at least a temporary shift back from public power to private power at the international level.

The United States has responded to the development of translational corporate power by trying to extend the exercise of sovereignty outside of its own borders, by, for example, controlling or regulating foreign subsidiaries of U.S. corporations. But, as nationality of corporations has faded, these efforts have proved ineffective. Companies move. The nationalities or loyalties of their top management are not necessarily coincident with where they are headquartered. Some corporations become essentially independent of geographic sites, production facilities, and national charters.

However, in spite of this erosion of sovereignty, national boundaries remain very real economical and political limitations. Private corporations may be caught in intolerable binds between conflicting laws and policies in the different countries in which they do business. The control of databanks and flow of information by, for example, the Council of Europe, can impact adversely on American companies doing business in Europe.

The picture of national sovereignty that emerges in 1987 is thus very different from the picture that was accepted in 1787. The challenges to national sovereignty in the future will be very different from those that were possible in the past, and will be shaped by the need for international response to continuing technological development.

A Democratic Republic

The United States was not the first nation in history to try constitutional government, but it set the pattern for those that followed. It was the first successfully to establish a stable union of what were then sovereign States. The Founders, men of their times, did not envision universal suffrage or equal opportunist y for all, yet they gave us the means to move in that direction. As James Madison said, when proposing on June 8, 1789, that the first Congress adopt a Bill of Rights:

> . . . the people have an indubitable, unalienable, and indefeasible right to reform or change their Government, whenever it be found adverse or inadequate to the purposes of its institution.

"A more perfect union" was needed in 1787 because of the economic chaos caused by the constant competition between the 13 original States, because of the threat of alliances between States and foreign countries eager to regain control in the New World, and because of the inability of the existing Confederation to finance itself or to control the actions of individual States. A strong union was needed to provide the stability and cooperation necessary for the economic and technological development of the vast resources of the new country. At the same time, the Founders greatly feared a strong national government that might abuse its power. Constitutional history since that day in many ways reflects the effort to maintain a balance between these conflicting goals.

The principle of representation, whereby one individual gave voice to the interests of his constituency, was already well established in 1787, both in England and on this continent. Since then, the United States has steadily broadened the franchise to all adults and enabled people to make more direct choices, by eliminating the indirect election of Senators, creating primaries to select Presidential candidates, enforcing a principle of equal weight for each person's ballot, and putting decision propositions on State and local ballots. These changes have helped to compensate for the unavoidable dilution of representation as population grew and the number of States increased.

Modern technology has however introduced complexities that have a serious impact on the representative process. The effect of technology on government structure has been most noticeable in the development of a massive Federal bureaucracy to provide the expertise for applying, using, and regulating technologies. The constitutional problems of such a structure have been alleviated in part by the application by the Supreme Court of the due process clause to administrative procedures.

Are information systems changing the nature of congressional representation?

But the growth of a "non-elected branch" of government has inevitably distanced the people from the day-to-day operations of government. The use of independent agencies—the Federal Communications Commission, the Interstate Commerce Commission, the Nuclear Regulatory Commission—to regulate technologies has also placed a serious strain on the boundary between legislative and executive functions. This further dilutes the representation process by diffusing responsibility within the government itself.

But effects of technology on representation are not limited to fostering the growth of a Federal bureaucracy. Technology also has direct effects on the very functions of representation, such as communicating with constituents, formulating policy, legislating, and overseeing executive agencies. The use of computerized mail systems, for example, has allowed the collection and analysis of data on constituent demographics and interests, and thus the segmentation and targeting of audiences to give political messages greater impact and saliency. The information available in computerized databases allows newly arrived Members to be more immediately knowledgeable and effective. Oversight of executive agencies can potentially be greatly enhanced by the use of electronic information and computer models to analyze budgets and evaluate programs, but it also becomes more difficult to evaluate highly technical management decisions about costly information systems operating at the edge of technological advance.

The mass media-newspaper, television, and radio—is a potent influence on the nature of representative democracy. The use of media to present a political image or personally to articulate and frame an issue has been expanded by C-Span and by the use of videotape by local stations, but has also been shaped by

the demands of the TV news format. The reporting of political news affects attitudes of the public and may distort the process of determining winners and setting agendas. Computerized analyses of voting trends in selected districts aid networks in predicting winners and losers long before the voting is finished, playing on the psychological tendencies of some people to jump on the bandwagon.

Television has also led to what might be called the industry of "image-making," in which more attention is paid to projecting a carefully designed political image than to explaining controversial policy positions. Critics charge that tracking and surveying public opinion has changed the focus of political news away from the substance of issues and reasoned analysis, and towards attention-grabbing headlines. The ability to inform and influence Congress may also have shifted from party loyalists with cross-cutting interests and motivations, towards organized interest groups —especially those that have the technological resources to mobilize public opinion in their favor—and towards "single-issue politics" under which organized groups of voters are able to exercise an influence greater than their number would suggest.

Does the proliferation of communications be tween elected representatives and their constituents enhance democracy? The Founding Fathers debated whether elected representatives were to reach decisions based on instructions from the public or were, by deliberation and debate, to arrive at some higher common good. The question of whether a representative should be 'instructed' by the sentiments of constituents, or whether he or she should lead popular opinion in a deliberative role continued in the First Congress, where Mr. Clymer, a member of the House of Representatives, said,

> If they have a constitutional right to instruct us, it infers that we are bound by those instructions. . . .This is a most dangerous principle, utterly destructive of all ideas of an independent and deliberative body.

Two hundred years later, this question continues to be debated. The use of telecommunications, either to survey public opinion or to send messages or protests to Congress, increases the likelihood of instructed representation. But the complexity of administering a technologically advanced society, the growth of population, the rise of bureaucracy, and the difficulty of maintaining public interest in political issues far removed from one's everyday life, tend to counter this trend toward instructed representation. They distance elected officials from the people, thereby allowing greater room for deliberation and independent judgment.

Would "electronic direct democracy" —public voting on issues by electronic systems—fit the constitutional concept of representative democracy?

Technology may in the very near future present the Congress with a dramatic choice between these two theories of representation. New technologies, such as interactive TV and videotex, raise the possibility of direct voting by citizens on some national policy issues. Whether these methods should be used merely to collect in-depth opinions or to register actual binding votes is highly debatable.

Advocates of direct electronic democracy claim that people would take more interest in government and become better educated on the issues, and that democracy would be the better for it. Where limited trials have been made, people do show increased interest in policy issues. But these issues have been local, and relatively simple ones. There has never been a national referendum, though one was proposed in 1907.

Those against the idea of direct voting on issues cite the assumed disinterest and inability of the average citizen to understand the complex subjects involved. This in turn could make the voice of educated, socioeconomic elites stronger. Alternatively, it could make for uninformed resolution of important matters of policy.

But technology may allow a move to direct democracy in incremental steps, rather than

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all at once. Other methods of electronic participation, including electronic town meetings, public teleconferencing, and public access to legislative databases are being used in some State and local governments. This kind of access to government could increase greatly in the future as information technologies become more usable and more accessible to more people.

The impact of technology on the principle of representative government thus can cut both ways. The increased complexity of government, in the 21st century and beyond, leads to governmental structures that can dilute its representative character. Yet technology offers compensating advantages that can increase the ability of government to serve the people it represents.

Federalism

Federalism in the United States is marked by:

- a union of autonomous political entities for common purposes;
- divided powers, with the Federal Government having enumerated powers and the States retaining residual power;
- operation of each of these governments within its assigned sphere upon all persons and property within its territorial limits;
- law enforcement powers for each level of government;
- supremacy for the national government within its assigned sphere in any conflict with state power;
- a dual system of State and Federal courts; and
- dual citizenship, national and state.

Since the Civil War, Federal power has clearly been in the ascendancy, and the same trends that are now challenging national sovereignty-expanding markets and centers of production, telecommunications networks, a mobile citizenry, and the homogenization of culture across boundaries-have contributed to the shrinkage in the role and authority of State governments.

Transportation and communications systems, tying this nation together physically, also tied the country together economically and politically, requiring an interdependence and cooperation that could only come from national action. Autonomous States could not coordinate the commercial development of navigable waterways, interstate roads, railways, and airports. The lack of uniformity in laws and the competition among State interests has led to Federal Government preemption of many areas of commerce, and precluded State control of nationwide systems necessary to ensure orderly and efficient economic development. Today, as a practical matter, the government of commerce is national and not local.

Current technological problems, such as nuclear and toxic waste disposal, water rights in the semi-arid areas of the West, and air pollution spreading from one region to another, need cooperation between the States and leadership, refereeing, and adjudication by the Federal Government.

This does not mean that federalism is thwarted or that there is no major role for St ate government. The criminal justice system, particularly as it relates to violent crime, remains within State control. Property ownership, the law of descent and distribution, and family relations are largely the province of State or local law. Fundamental government services—fire, police, water, zoning–by and large are provided by State or local government. Technological change will however influence how the States will govern in these respects and how the Constitution will guide that governing.

Moreover, new information and telecommunications technologies may again operate to change the balance within federalism by enhancing the ability of States to act independently or cooperatively, reducing the need for national solutions to problems. Information systems, for example, have allowed States to cooperate much more effectively in the areas of civil and criminal justice and public health.

Future technologies will, as they have in the past, most likely cut both ways; concentrating some powers in the Federal Government and enabling the States to retain and expand

Has technology undermined the province of the legislature to "make and declare war?"

In an emergency, need Congress assemble in Washington to act, or could it use telecommunications?

others. While the use of information systems and computerized databases provides additional power to the States, additional Federal regulation may be required to protect individuals' privacy rights in an era of nearly unlimited surveillance ability and ability to combine information. This tension, too, presents challenges to constitutional interpretation.

Separation of Powers

> In framing a government. . . you must first enable the government to control the governed and in the next place, oblige it to control itself.
> –*Federalist, No.* 51

The hard-won power of the English Parliament to control the excesses of the Throne was for the Founding Fathers a valuable heritage. As structured by the Constitution, political power and function in the Federal Government is separated among three distinct and mutually dependent branches—the legislature, the executive branch, and the courts. Moreover, a set of institutional and procedural checks was created to make it difficult for one branch to act rashly or independently of the other two branches.

The power balance in the U.S. Government has shifted many times, sometimes by a President's initiative, at other times by Congress' reassertion of its powers or duties, at yet other times by the intervention of the courts. War and technological change have been two dramatic factors in changing the locus of power between the President and Congress. Both have tended to pose threats to public safety that required swift, decisive action based on expert knowledge, and thus to shift responsibility toward the Executive rather than the more deliberative Legislative Branch of Government. War has been the greatest promoter of presidential power, but until World War II, this was usually temporary. More recently, the power, the range, and the speed of modern weapons have favored a continued shift in power toward the Presidency.

As technological advances give rise to constitutional challenges, moreover, the powers exerted by the Supreme Court are likely to increase. Never before in our history have so many aspects of daily life been subject to litigation, both over the respective powers of the President and Congress and over the relationship of government to the individual. It is a unique feature of American democracy to rely so extensively on courts to monitor the authority of elected branches of government. Exercise of this power will likely ebb and flow as it has in the past, but it is nonetheless certain that technological change will place new and continuing demands on the courts to interpret the fundamental charter of American government.

THE BILL OF RIGHTS AND CIVIL WAR AMENDMENTS

The first ten amendments to the Constitution spell out those inalienable rights for which the 13 colonies, in 1776, had defied England; and for the greater security of which, 11 years later, they gave up some of the powers of nation-statehood to create a more perfect union. Many of these rights were already deeply rooted in English common law and in the aspirations and struggles of the peoples of many countries who came to the New World. Although these rights have been interpreted as limitations only against the exercise of power by the Federal Government, the three amendments added after the Civil War-the 13th, 14th, and 15th–mean that most of them limit the powers of State governments as well. These 13 amendments together are the great American charter of individual liberty against potential oppression by government.

The Bill of Rights embodies the most fundamental political, intellectual, and religious rights in the 45 words of the First Amendment. It also forbids arbitrary and lawless governmental actions that threaten life, liberty, or individual property, and has been interpreted to recognize a zone of privacy on which government has no right to intrude. The rights of those suspected of or convicted of crime are spelled out and the criteria for citizenship and enjoyment of these rights and protections are set forth.

The Bill of Rights and Civil War amendments have proven triumphantly robust through the confounding technological, social, economic, and political changes of the past two centuries. They are deeply involved in issues arising from technological change as it affects relationships between people and government.

The First Amendment

Freedom of speech and press, the right to assembly, and the right to petition the government for redress of grievances are embodied in the First Amendment:

> Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances.

The provisions of the First Amendment have been interpreted to provide a bulwark against government intervention in the most basic elements of our democracy—the expression of thought, opinion, and belief. As necessary conditions to democratic governance, the rights embodied in the First Amendment occupy a "preferred position" in the hierarchy of constitutional rights. As Justice Rutledge, speaking for the majority of the Supreme Court, said in 1945:

> This case confronts us with the duty . . . to say where the individual's freedom ends and the State's power begins. Choice on that border, now as always delicate, is perhaps more so where the usual presumption supporting legislation is balanced by the preferred place given in our scheme to the great, the indispensable democratic freedoms secured by the First Amendment . . . That priority gives these liberties a sanctity and a sanction not permitting dubious intrusions . . .
>
> *Thomas v. Collins, 1945*

In spite of this preferred position, the Supreme Court has never interpreted the freedoms of religion, speech, press, or assembly to be without limits. Government can prohibit speech that threatens national security, that is obscene, or that is an incitement to violence or to the overthrow of the government. It can place reasonable restrictions on the time, place, and manner of speech, and can regulate speech that takes place over the airwaves. This often involves a balancing of individual rights against the interest of government, in the context of contemporary economic, political, ethical, legal, and scientific or technological values.

Science acts as arbiter of what can be done to change and exploit the physical world. It thereby renders speech more potent, and moves back the threshold at which the government can claim a compelling reason for limiting freedom of expression. When the connection between science and technology is di-

Do national security restrictions and export controls effectively negate the First Amendment protection for scientific communication?

Does a scientist have a constitutional right to do research on any subject? Or are there topics that should be "forbidden knowledge?"

rect enough to pose a risk to national security or economic stability, the government may and does restrain scientific communications.

It may do so either by making research funding conditional on secrecy, by prohibiting speech or publication on specific scientific topics, by withholding patents, or by controlling exports of either products or production know-how. The question to be considered now and for the future is when those modes of restraint, taken together, place an intolerable burden on the exercise of First Amendment freedoms.

Knowledge can be misused, and technology can be abused, by being turned to ends that threaten life or defy cherished values. The question arises, therefore, whether there are areas of scientific and technological research that should not be undertaken. Should the pursuit of certain kinds of knowledge be forbidden? The question has been raised at various times about research on atomic energy, recombinant DNA, neuroscience, eugenics, birth control, and fetal tissue. Some thoughtful people, laymen and scientists alike, argue that science and technology are not neutral; that, once unleashed, they may have pernicious effects. They believe that some kinds of knowledge, or some methods of experimentation are ethically unacceptable and ought therefore to be curbed.

Other equally thoughtful people argue that all knowledge is valuable and necessary to the continued progress of civilization. Advocates of this view argue that the First Amendment guarantees of free speech and press, and its prohibition against government establishment of religion reflected the Founding Fathers' confidence, born of Enlightenment accounts of Galileo and Newton, that science is a beneficent force, not to be interfered with by government or by religious institutions.

Yet there have been few judicial decisions that address directly the implications of the First Amendment for the constitutional status of scientific research, and there are no court decisions that establish definitively a First Amendment right to conduct research on any topic, without limitation or restriction. The prevailing assumption is that scientific activity has general protection, subject to limitation where a clear national interest is involved.

Even where prohibitions on research are not involved, however, science and technology may eventually raise constitutional issues. The Federal Government is often the only source of adequate funding for scientific research in which industry has no interest. There is no constitutional right to Government research funding. But objections to some areas of research, such as those involved in interspecies genetic exchange and perhaps someday human cloning, are sometimes rooted in values that are intrinsically religious in nature yet not universally shared. Government restrictions on funding particular research projects in these sensitive areas may in the future be challenged as suspect under the establishment clause of the First Amendment, or the equal protection clause of the Fourteenth Amendment.

Freedom of the Electronic Press

As it first did with the printing press and again with radio and television, new technology will give rise to new ways of communicating, which amplify the ways in which individuals and organizations express themselves. Information and communications technologies, such as satellites, computers, and digi-

Does "freedom of the press" apply to electronic bulletin boards or to media satellites?

tal transmission lines, are, like the telegraph, telephone, radio, and television before them, changing the range, cost, and quality of communications.

Taken together, advances in computers and telecommunications may change the concept of "the press. Today, the term usually refers to a formal organization that gathers and publishes or broadcasts news. Such communications generally take the form of one-to-many exchange. In the future, that exchange may shift to many-to-many communications in which people with common interests share information amongst themselves, as with electronic bulletin boards.

With these changes will come the prospect of new First Amendment challenges to the power of government to regulate access to and ownership of communications media. New technologies, such as electronic publishing, may not fit easily into old models of regulation, and distinctions between the First Amendment rights of print publishers, television or radio broadcasters, and common carriers will become increasingly difficult to justify.

New capabilities for the press to gather, store, and retrieve information on individuals may require that rules of Liability for constitutionally protected speech be reexamined. The potential for technology to decentralize the editorial function may raise questions of editoial control and liability under the First Amendment. And, in an era of global communications, the question will be raised of whether First Amendment rights extends to speech transmitted to this country by foreign speakers.

Has the notion that broadcasting frequencies are scarce, and thus subject to regulation, been outmoded by technology?

The Fourth Amendment

The Fourth Amendment is a strong affirmation of individual privacy and a barrier to the exercise of arbitrary power. It says:

> The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched and the persons or things to be seized.

This right had a long history in English common law. Sometimes colloquially expressed as "a man's house is his castle, " it meant that one had a right to expect that one's home, possessions, and person were safe against arbitrary and forceful intrusion by the King's agents. At the same time, it recognized that the lawful agents of the state can intrude on private property to execute or enforce the law, so long as they obey certain procedural rules that protect the subject of the search.

This protection was understood in 1787 to limit and regulate physical trespass, and the seizing of papers, effects, or "things." Technology began to threaten the effectiveness of this protection about a century ago. The telegraph and telephone allowed information about oneself to be separated from person, places, paper, and objects because it could exist in the form of pulses of electricity. In 1928 (and again in 1942) the Supreme Court declared that wiretapping was not forbidden by the Fourth Amendment because there was no physical

Does the Fourth Amendment prohibition on "unreasonable searches and seizures" cover all kinds of electronic surveillance?

trespass and physical "papers or effects" were not seized.

Congress grappled with this question in the debate that led to the Federal Communications Act of 1934 without finding a solution that fully satisfied either itself or the courts. Not until 1967 did the Supreme Court say that the intent of the Fourth Amendment was to protect people and their privacy, rather than places or property as such. The Court said that electronic snooping should be considered a form of search and seizure governed by rules and procedures adopted from traditional safeguards but adapted to new technological capabilities.

Now, there are nearly unlimited means of electronic surveillance, some from great distances (even from satellites) and with almost no risk of detection by those being watched. Intelligence agencies and law enforcement forces can locate, identify, track, and monitor people or vehicles by using devices that pick up and analyze images, sound waves, vibrations, heat, or light. Electronic devices can be fixed to people, their clothing, or their vehicles—and possibly in the future could be embedded in their bodies-so that their movements are tracked or recorded. Some local jurisdictions, for example, already use house arrest, continually monitored by electronic anklets or bracelets worn by prisoners, as an alternative to prison.

The rule laid down in 1967, and later reaffirmed by the Supreme Court, was that one is protected against surveillance where there is "a reasonable expectation of privacy. " With the remote sensing devices of today or tomorrow, the places or situations *in* which there is a reasonable expectation of privacy, in the sense that being watched or overheard would

Do you have a privacy interest or a property interest in your blood, urine, breath, or DNA?

not be feasible or even easy, are drastically shrinking. The Congress has already taken steps in the Electronic Communications Privacy Act of 1986, to bring many new electronic technologies under statutes spelling out the applications of constitutional principles of protection against unreasonable searches and seizures. Almost surely, the Congress and the Courts will be asked to consider other new technologies in the future.

At the opposite extreme from remote sensing is what may be called intimate sensing. Modern technologies use the substance of, or emanations from, the human body and its cells and tissues to detect the presence or the identity of a person, track one's movements, or provide evidence of one's past behavior. Such technologies can be applied to, for example, the use of drugs, sexual activities, or exposure to disease. There are new techniques for finding fingerprints, and computer systems that match them against huge banks of prints on file. Biometric security systems can identify a person by hand geometry, voice patterns, retinal blood vessel patterns, or other physical characteristics. Analysis of DNA, the genetic material within all living cells, also can be used in identification. Blood, semen, and other body fluids can be tested for a variety of factors associated with past experience or present performance.

Until 1967, the courts did not allow the seizure of "mere evidence" (i.e., things that were not themselves "the fruits or instrumentalities of crime" or contraband). But it is now well established that blood, semen, fingerprints, hair, handwriting samples, and other such evidence can be taken. Moreover, such seizures have been held not to violate the Fourth Amendment or other constitutional prohibitions against forced self-incrimination, if their disclosure is otherwise reasonable.

If law enforcement officers have effective "non-lethal weapons," will any use of deadly force become unconstitutional?

Questions about privacy and the reasonableness of searches will continue to arise. We have not, for example, fully probed applications of the Fourth Amendment to computer memory or to future testing, screening, and analytical capabilities applied to the human body and brain.

The Fifth, Sixth, and Eighth Amendments

The rights of those suspected, accused, or convicted of crimes are set out in three of the ten amendments that make up the Bill of Rights, and elsewhere in the Constitution. This strong emphasis on the rights of the suspect or criminal was not because the Founding Fathers were unconcerned about crime, but rather because they were well aware that tyrannical Governments can use accusations of common crimes to rid themselves of rebels or dissidents.

The Fifth Amendment guarantees the right to a grand jury and prohibits double jeopardy, compelled self-incrimination, and the taking of life, liberty, or property without due process of law. The Sixth Amendment guarantees a speedy and public trial by impartial jury of one's peers, the right to have and to compel the testimony of witnesses, and to have the assistance of counsel in all criminal prosecutions. The Eighth Amendment forbids the imposition of excessive bail and fines, or cruel and unusual punishments.

All aspects of law enforcement and criminal justice have been profoundly affected by technology over the last decade, and this technological transformation is continuing. At the heart of it are computer and telecommunication technologies, computerized databases, and communications networks. But two other primary areas of science and technology are also of great importance. The first is forensic science, which is especially important in the detection of crime and in the development of legal evidence of crime and guilt. The second involves social science methods of statistical analysis, computer models, simulation, and expert systems. These advances are being used in prediction of criminal behavior and recidivism, for more effective targeting of enforcement resources, and for support of legal, judicial, and administrative decisionmaking, including decisions about bail, jury selection, sentencing, and probation.

The Sixth Amendment guarantees a speedy and public trial by an impartial jury, and the right of defendants to have the advice of trained counsel, to confront and cross-examine prosecution witnesses, and to compel the testimony of defense witnesses. One of the most controversial contributions of social science to criminal justice procedure has been recent attempts at "scientific selection' of juries. There have also been experiments with the use of telecommunications in taking testimony from witnesses not physically present in the courtroom, such as abused children.

Significant changes are now occurring in the treatment of convicted felons for reasons having to do with both technological and social factors. These changes are likely to result in challenges to conventional understanding of Eighth Amendment protections against excessive bail or fines, and cruel and unusual punishments. The changes are driven by growing determination to reduce crime, particularly successive crimes of repeat offenders, and by the counter pressure of overcrowding in prisons. But social decisions in this area are becoming more complex and difficult because of:

- scientific research on criminal behavior patterns;
- the emergence of technological alternatives to imprisonment; and
- the growing possibility that biochemical and genetic research will identify determinants of (or strong forces on) criminal

Can a judge give you a choice of prison, or home arrest wearing an electronic anklet? What if you are required to pay for the use of the anklet?

behavior that are beyond the control of the offender, and thus challenge assumptions underlying concepts of both punishment and rehabilitation.

The emphasis on reducing crime by effective law enforcement and punishment (or rehabilitation or, at a minimum, incapacitation) has led to the greater use of preventive detention. This, in turn, led to a constitutional challenge, using the principle of prohibition of excessive bail, recently resolved by the Supreme Court. The pressure of overcrowding, which has been found by some courts to constitute cruel and unusual punishment, is leading many local jurisdictions to experiment with alternatives to prison. These include electronically monitored house arrest, at least for non-violent offenders who have a home and a job; and for some other offenders, chemical, psychological, and behavioral treatments aimed at behavior modification. Even surgical intervention-e. g., castration—has been proposed by one court as an alternative to prison.

Alternatives to prison maybe challenged as "cruel and unusual punishment. Courts have generally interpreted "cruel" to mean the imposition of bodily pain, but have recognized that this definition may change over time. Or the alternatives may be challenged as invasions of the rights of prisoners, who are considered to retain some privacy rights. As these techniques have been used so far, they always require the consent of the subject and are considered a benefit or privilege for the offender, who would otherwise go to prison or remain there longer. Some, however, question the reality of informed consent when the alternative is imprisonment.

Finally, to the degree that alternatives to prison are desirable options for the offender, there are questions about availability on an equitable basis and hence potential constitutional issues of discrimination. These issues arise because at least some of the alternatives to prison, such as electronically monitored home arrest and privately operated prisons, require prisoners either to pay the costs of the program or to have steady employment and assets, such as a fixed abode with telephone connections. Thus, those without means are likely to be ineligible. Challenges based on this factor could become even more insistent if risks of incarceration become significantly worse because of the spread of AIDS in prisons.

The use of science to gather, analyze, and present evidence in criminal proceedings can raise troublesome questions about the accuracy, reliability, and credibility of the methods used. Questions are also raised about the ability of jurors, lawyers, and judges to understand fully both the significance and the limitations of such evidence. These questions, in turn, may raise due process issues. Computer models and statistical analyses used to support judicial and administrative decisions may also be challenged on constitutional grounds, particularly if used in a predictive mode (what is the probability of this offender committing another crime if he or she is paroled?). Such models are necessarily based on information about characteristics of or past behavior of categories of people, and are then used to predict or assign probabilities to the behavior of an individual. Thus they are suspect of discrimination.

Law enforcement agencies are trying to develop technology to reduce the need for deadly force when subduing or arresting subjects. The goal is to reduce both the loss of life and the liabilities or penalties being levied on local jurisdictions when lives are lost. If nonlethal weapons become widely available and effective, then use of lethal weapons in all but the most compelling circumstances could be challenged as unconstitutional, because it could be disproportionate to the need or risk.

A fundamental assumption underlying constitutional provisions related to crime and punishment—and indeed, a basic assumption

of western civilization-is that people have free will or self-determination. They can be punished for crime or can be offered the opportunity for rehabilitation because they chose to break the law and can thus choose not to break the law. With a growing, although still very early and spotty, knowledge about genetic, biochemical, and environmental influences on behavior, cognitive processes, and personality, the assumption of self-determination is being, if not eroded, at least reexamined and qualified. Courts and legislatures are participating in that reexamination.

Other Amendments

Several of the other amendments within the Bill of Rights have receded in importance over the last two centuries, perhaps again in part because of changing technology. The Second Amendment says that a militia is "necessary to the security of a free State, " and guarantees "the right of the people to keep and bear Arms. " The Third Amendment strictly limits the quartering of soldiers in private houses in time of peace. Neither of these amendments has been applied very often since 1792, although the Second Amendment is often cited by those opposing gun control laws. These amendments were intended to safeguard the ability of citizens to resist both hostile invasion and tyrannical domestic government, and to establish the primacy of civilian rights over a (professional) military force. The growth in power, scale, destructiveness, and cost of military weapons, and even of law enforcement weapons, has effectively nullified the objectives of these two amendments.

The right of trial by jury in civil cases is enshrined in the Seventh Amendment, primarily to preserve the common law distinction between the province of the court (which decides issues of law) and the province of the jury (which decides questions of fact), a distinction of great importance in the 18th century, although taken for granted now.

Equal Protection

The Fourteenth Amendment provides that "No State shall. . . deny to any person within its jurisdiction the equal protection of the laws." Once the last resort of constitutional argument, this phrase assumed modem importance in the 1954 decision in Brown v. Board *of Education of Topeka* that segregated schools were unconstitutional. Since that time, the jurisprudence of equal protection has expanded considerably. Modern interpretations of the equal protection clause subject governmental categorizations of people to various levels of scrutiny, with classifications along race and alienage receiving the strictest scrutiny, and then gender.

The prohibition against invidious discrimination contained in the equal protection clause is based, in large part, on the moral and political conviction that people are essentially equal, and that government action cannot be based on designations of a group that are arbitrary from a moral and political point of view.

Although science and technology were probably not directly responsible for the emergence of equality as an important constitutional value, they have contributed greatly in its implementation. The Brown decision relied heavily on the findings of social science to support its reasoning, and modern technology has helped to reduce many of the barriers to employment and military service that were once thought to be justifications for discrimination based on gender.

In the future, science and technology will contribute to ongoing debate over the meaning of, and basis for, equal protection of the law. Thanks to science and technology, people are living longer, and continue to be productive well into old age. It is possible, therefore, that classifications based on age will become ever more suspect.

Furthermore, as our knowledge of the genetic component of ability, aptitude, and behavior grows, it may be possible to identify

not only what is common to all human beings, but also what is different. Should science establish characteristics belonging to distinct categories of people, we may face constitutional dilemmas between moral value and scientific truth. Science may test the concept of "equality," which has been left an undefined postulate of the law, and require that it be better articulated and more firmly rooted in moral and legal discourse.

Due Process of Law

One of the most well known and cherished of constitutional phrases appears in the Fifth Amendment: " . . . nor [shall any person] be deprived of life, liberty, or property, without due process of law. . . ." It is repeated in the Fourteenthth Amendment, this time as a specific restraint on State governments.

The phrase or its equivalent in English common law and some State constitutions, often expressed as "the law of the land, " is derived from Magna Carta. As they have evolved in the jurisprudence of the Fifth and Fourteenth Amendments, the due process clauses have come to stand for two independent protections: an assurance of procedural rationality, consistency, and integrity in any government action that could deprive a person of "life, liberty, or property"; and certain substantive rights not laid out explicitly in the Constitution but deemed essential to the principles of American democracy.

In its procedural meaning, "due process" does not turn entirely on the existence of rules laid out by legislatures or administrative agencies. It is instead an independent protection against the deprivation of rights established by the Constitution or by State or Federal law. It forbids capricious governmental actions. The Supreme Court has held, for example, that due process standards must be met in such varied contexts as the allocation of welfare payments, aspects of criminal trials not covered by more explicit provisions, the suspension or expulsion of children from public schools, and the dismissal of persons in the employment of State or Federal Government.

As a source of substantive rights, the concept of "due process" has had a more checkered history. From the turn of the century into the 1930s it stood for a right to contract, and was used by the Supreme Court to negate many laws, such as laws aimed at occupational health and safety or conditions of employment. In more recent times it has been used, for example, to protect the liberty to educate one's children in a school of one's choice, to study a foreign language, to use contraceptives, and to travel across state lines. The due process clause of the Fifth Amendment, moreover, is the source of the substantive protection against invidious discrimination by the Federal government, a right explicitly protected by the Fourteenth Amendment against intrusion by the States.

Technological change has affected both dimensions of due process. On the procedural side, for example, pretrial publicity facilitated by modem means of mass communications presents complexities in criminal trial procedures that were unknown when the due process clauses were added to the Constitution. In terms of substantive rights, science and technology have developed new ways of intruding on personal autonomy protected by due process.

The Penumbra of Privacy

The rights and protections spelled out in the ten amendments of the Bill of Rights and in the Fourteenth Amendment affirm and define a sphere of personal autonomy that is protected against any but the most powerful overriding interests of state. This principle was a basic tenet of 18th century political thought and was and is a cornerstone of constitutional government.

But this right to privacy was seldom articulated until 1965. Then, in the case of *Griswold v. Connecticut,* the Supreme Court struck down an anticontraceptive statute as an infringement of the fundamental right of 'marital privacy. The reasoning in this and subsequent cases is that the intent of the Bill of Rights as a whole and hence of the Fourteenth Amendment, was to provide an addi-

If your life can be maintained indefinitely by a machine, do you have a constitutional right to treatment? to refuse treatment?

tional bulwark against governmental intrusion on rights so fundamental that one need not or could not list them. They were inherent in the idea of free men banding together of their own accord to form a government.

The extent of this sphere of personal autonomy is now being tested, and nowhere more urgently than in regard to decisions about one's own body —i.e., decisions about life, death, and reproduction. Medical science and technology, and even more fundamental advances in biological sciences, are significantly extending the range of choices and decisions that individuals and society have, or may have in the future, involving values and trade-offs that are both intensely personal and value laden.

The decision to acceptor reject life-support systems is one that more and more people are already having to make; and the decision of whether and when to terminate the use of such systems may be all the more difficult, since it must usually be made by someone other than the user. In the future "life-support systems" may be entirely internal-e. g., a totally implantable heart. Will the ethical, legal, and constitutional questions be the same? The capability of saving, maintaining, and enhancing life with technological systems that, because of their complexity, risk, and cost, are inherently and necessarily limited resources will raise public policy issues, as did kidney dialysis. Is the opportunity to continue living to be a market good or will there be another means of allocating or rationing these technological capabilities? These painful choices, however made, will likely be challenged on constitutional grounds, as have the funding of other advanced medical technologies.

Would life-long quarantine of AIDS sufferers be unconstitutional? What about mandatory AIDS testing?

At the beginning of life, also, constitutional challenges are likely to arise from new reproductive technologies such as third-party surrogacy, use of donated frozen embryos, and fetal surgery and other interventions in utero. The common thread in extreme medical interventions at the beginning and end of life is that new and enhanced medical capabilities force new decisions on individuals and families, or change the balance of risks and benefits involved in traditional decisions, and by so doing, force legislators and courts to reexamine the interest of the State in those decisions.

In public health programs also, new constitutional issues are emerging that require reexamination of the traditional balance between individual rights and the general welfare. Enhanced capability to test individuals for exposure to risk, for infectivity, for **use** of prohibited or controlled substances, and for vulnerability to disease or injury are raising serious questions about the government **use** of such techniques and its obligation to protect the privacy of the subjects. **Even** more intrusive or restrictive social control measures may be proposed in the future, ranging from quarantine of individuals to regulation of critical industries, whenever our technological capability to manage or reduce or remove risks lags behind our scientific capability **to** identify and track them.

The power to intrude effectively into the core of personal privacy and autonomy in order to protect the interests of society **was** technologically limited in 1787. The ability of government to know about, and to act with regard to a specific individual, was in most cases slow, cumbersome, and highly visible, and so in most cases was effectively constrained by the simple prohibitions listed in the Bill of Rights. The power of government to investigate, monitor,

If a violent psychotic murderer could be reliably cured with surgery or long-acting implantation of drugs, would he or she have a constitutional right to refuse treatment?

and manipulate the behavior of specific individuals is not now so technologically limited, and it will be less so in the future. Biological, chemical, electronic, social, and behavioral technologies can be expected to extend and strengthen those capabilities. The limits on their use must be found in law and policy, and in the continued reliance on the Constitution as the supreme law of the land. Strong legislative and judicial actions may be necessary to protect that sphere of individual, private activity that the Founding Fathers cherished and that the Constitution has always implicitly protected.

CONCLUSION

This brief review of the principles of the United States Constitution highlights some of the ways in which advanced technology will test the basic premises of American government in the years to come. More detail will be provided in a series of Special Bicentennial Reports by the Office of Technology Assessment. These reports seek to stimulate serious consideration of some of the difficult constitutional problems that must be faced as our Constitution enters its third century. The Constitution has proved to be enormously resilient in the past as technological change has altered the basic functions and responsibilities of government. It will need to be equally resilient in the future.

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