

# FORUM

FOR APPLIED RESEARCH AND PUBLIC POLICY

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# Patent Pending

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**C**oal mining was a mortally dangerous profession 200 years ago. Apart from poisonous gas, falling rock, and black lung, there was the ever present threat of explosion. The open-flamed lamps of miners occasionally encountered firedamp—a mixture of methane and air—with disastrous results. Explosions snuffed the lives of hundreds of miners every year.

At least they did until Sir Humphrey Davy visited a coal mine in the early 1800s. Davy wasn't a miner—he was the foremost chemist of his day—but he identified with miners and understood the fragility of their lives. He was particularly concerned about firedamp. After a couple of years' work, Davy developed a safety lamp that isolated the flame from the surrounding gas. Davy's device saved thousands of lives, to the gratification of miners, their families, and generations of offspring who could thank him—almost as much as their own parents—for having been born.

Davy would not patent his invention, however. He believed that any invention dedicated to saving lives should be freely available to anyone who could benefit from it.

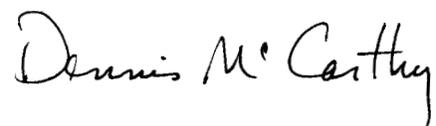
Patent law has come a long way since Sir Humphrey Davy's day. Take Dolly, the cloned sheep, for instance. She's a patentable product. And Craig Venter, one of the leaders of the Human Genome Project—which raises hope for curing cystic fibrosis, Alzheimer's disease, obesity, and dozens of other human frailties—has already applied for over 6,000 patents, based on his genome research. Although the U.S. Patent Office has recorded only a few thousand DNA patents so far, that number will eventually reach into the millions.

To obtain a patent in the United States, you must show that your invention is new, useful, novel, and nonobvious. Ideas can't be patented. Discoveries of natural objects can't be patented. Thus you can't patent a gene in a chromosome. But if you extract the gene, you can. Don't ask me to explain why—the logic breaks down here somewhere.

Patenting life is just one of the troubling topics discussed in this issue of FORUM. Our contributors take on other items—such as growing organs from stem cells, biological warfare, and the environmental destruction of Kosovo—that you may also find unsettling. Still, there's something about the notion of people holding patents to my body parts that I find particularly disturbing.

Proponents argue that patents provide an economic incentive for research. They claim that progress demands patents, that technology would never develop without them. Does that sound cynical to you? Granted, patents have a respectable lineage that parallels the rise of modern technology. Even Venetian glass blowers in the late Renaissance had something akin to patents to protect their craft from upstart entrepreneurs. Still, Sir Humphrey Davy wasn't driven by patents to perfect his safety lamp. If the patent proponents are right, you have to wonder how technology ever got past the Bronze Age.

Maybe the cynics are right. Maybe times are different. Maybe researchers won't work on unpatentable biotechnology today if patentable technology is more securely lucrative. Maybe. But I doubt it. At least I hope not—for all our sakes.



Editor in Chief

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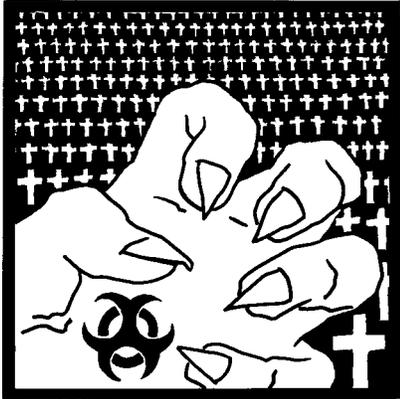
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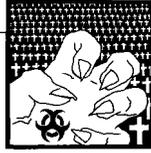
# War Games

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## Agents of Death

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# The Age of Angst

**T**he failure of Congress to ratify the Nuclear Test Ban Treaty in 1999 signals to the world that resolution of the nuclear threat remains an elusive goal. Meanwhile, there are new menaces afoot. Chemical and biological weapons, for example, are not so neatly contained as nuclear arms so far have been.

Chemical weapons can be made from substances in common use, says Michael Moodie with the Chemical and Biological Arms Control Institute. An estimated dozen countries today are known to be actively pursuing chemical or biological weapons programs. Closer to home, the recent spate of anthrax threats across the country has added to the nation's jitters and helped spur the administration to beef up its defensive capabilities. Because components of these weapons are so easily obtained, however, Moodie says that "the critical factor shaping the proliferation landscape is not technical capability, but political choice."

Several recent presidential directives and acts of Congress aimed at dealing with weapons of mass destruction have resulted in sharp increases in the budget for counterterrorism activities. Peter Chalk at Rand Corporation says that in fiscal year 2000, President Clinton asked for \$10 billion to thwart such attacks. Yet these preparations are meant primarily to fend off mass attacks. The nation, indeed the world, remains vulnerable to

rogues acting alone or through small groups linked in cyberspace. In February of this year, for example, Wall Street shook as unknown hackers targeted perhaps the softest underbelly of national security: the economy.

As the United States, and indeed most of the developed world, increasingly loses its stomach for conventional ground warfare, sanctions have not lost their appeal as an apparently harmless form of coercion. Bernard F. Griffard at the U.S. Army War College says these measures have proven less effective than intended and much costlier than imagined, compromising the armed forces' ability to prepare for traditional wartime missions. Moreover, public opinion holds great sway in the government's decision whether to intervene in international affairs.

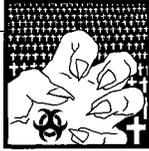
Though political instability is easy to ascribe to high-profile villains such as Saddam Hussein or Slobodan Milosevich, an even more sinister underlying cause for political instability is resource scarcity. Few of us who bask in a global economy based on high consumption of goods and foods produced anywhere realize that half the world's population, or 3 billion people, rely almost entirely on local resources, says Thomas Homer-Dixon at the University of Toronto. A severe imbalance between haves and have-nots magnifies critical shortages. Land degradation, water pollution, and forest loss, combined with a soaring

population, increase the likelihood of civil strife that will inevitably spill over national boundaries and spoil the party for the rich.

With natural resources at a critical point in developing countries, industrial pollution, like the February 2000 cyanide spill from a copper mine in Romania, remains a threat in many developed countries. This international tragedy illustrates the magnitude of the environmental crisis in the region. In fact, the suspected environmental damages from Operation Allied Force pale in comparison, says Rob de Jong, who was part of a recent Balkans Task Force team of the United Nations Environmental Programme. The task force, charged with assessing the damages, found the Allied Forces' precision targeting frighteningly accurate. Their on-site inspections at several bombing sites revealed a number of hot spots from military operations. The task force's assessment disclosed, however, deeper and more longstanding environmental problems. It will take a concerted international effort to clean up after the conflict and to address the underlying neglect of the region's environment.

In the past decade, the phrase *the end of the Cold War* has recurred with numbing frequency in the pages of FORUM. Perhaps it is time to coin a new phrase for the dawn of a new millennium: the age of angst.

*The Editors*



# Agents of Death

*Unchecked proliferation of modern chemical and biological weapons may radically alter the terms of warfare.*

BY MICHAEL MOODIE

**S**ince the end of World War II, the debate over proliferation of weapons of mass destruction has been dominated by discussions of nuclear weapons. The last several years, however, have seen growing concern about chemical and biological weapons. In the years ahead, chemical and biological weapons may, in fact, overshadow nuclear weapons as the primary proliferation issue.

Chemical weapons are poisons that incapacitate, injure, or kill through their toxic effect on the human body. They are generally classified as blister, blood, choking, incapacitating, or nerve agents, depending on which part of the body they are designed to affect. Some chemical agents can be lethal when vaporized and inhaled in amounts as small as a few milligrams.

Biological weapons are living organisms or the byproducts of living organisms used as instruments for waging conflict. In essence, biological warfare is the deliberate spread of disease. Biological weapons generally are categorized as bacteria, viruses, rickettsia, and toxins. As lethal as chemical weapons can be, biological weapons can be many times deadlier pound-for-pound. Laboratory tests on animals, for example, indicated that, if effectively disseminated and inhaled, 10 grams of anthrax spores could produce as many casualties as a

ton of chemical nerve agent.<sup>1</sup>

Chemical and biological weapons are easy and cheap to produce in comparison with nuclear weapons. Illicit chemical and biological weapons programs are difficult to detect since the technology, which is also used for legitimate commercial, medical, agricultural, and other purposes, is readily available. Chemical and biological weapons could also have great strategic impact; for example, an effectively disseminated biological weapon can produce levels of casualties comparable to those of a small nuclear weapon.<sup>2</sup>

Chemical and biological weapons could become the weapons of mass destruction of choice in the decades ahead, particularly for actors looking for major, but relatively cheap, leverage in pursuit of ambitious goals. Chemical and biological weapons could be very attractive to countries with regional designs against neighbors with limited military capabilities.

But they could also be valuable to such states in a confrontation with a major power like the United States. These weapons would allow even small nations to avoid contesting U.S. conventional military power directly by using an asymmetric strategy that seeks to exploit U.S. vulnerabilities.

The emergence of terrorist groups or fanatical individuals with motivations and world views far different from those of traditional political terrorists increases the risk that non-state actors—that is, those operating on their own without government support—might consider these weapons as a contingency. In-

deed, some people contend that bioterrorism is “the single most dangerous threat to our national security in the foreseeable future.”<sup>3</sup>

#### Ancient Arts of War

**T**he use of chemicals as a weapon of war dates far back in time. Historians noted the use of toxic fumes in conflicts in India as far back as 2000 BC. In 1591, Germans burned combinations of shredded hooves and horns with a fetid gum resin to produce noxious clouds to disrupt enemy forces. Even modern chemical weapons have been around a long time. The British chemist Sir Humphrey Davy prepared the respiratory irritant phosgene in 1811, and the chemical today known as mustard was synthesized in 1854. The most lethal chemical agents, the nerve gases, were initially developed from German research into organophosphorous pesticides in the 1930s.<sup>4</sup>

Biological weapons also have a long history. An early example of biological warfare can be dated to 1346 at Kaffa—now Fedossia, Ukraine—where plague-ridden corpses of Tartar soldiers were catapulted over the walls of the besieged city. In another historical incident, British commander Sir Jeffrey Amherst provided smallpox-infested blankets to native Americans around Fort Pitt during the French and Indian Wars.<sup>5</sup>

Development of modern biological weapons dates to the early decades of the 20th century. Some people contend biological agents were used during World War I. And every major combatant—including the United States, Canada, Britain, France, the Soviet Union, Germany, and Japan—had a biological weapons program during World War II. Japan, however, was the only nation that actually used biological weap-

ons such as anthrax, plague, and cholera during that conflict.<sup>6</sup>

After World War II, many countries sponsored chemical or biological weapons programs, or both. The United States developed and produced chemical weapons, eventually amassing a stockpile of about 30,000 tons of chemical agent, the second largest program in the world after that of the Soviet Union.

The United States also continued

Soviet Union and the United States were driven by the NATO-Warsaw Pact standoff in central Europe. At the time, the United States and its allies perceived a need to pursue a chemical weapons program to deter the use of chemical weapons by other states through threatened retaliation in kind.

When an opponent can deliver huge quantities of the right types of chemical agents with precision

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### **During the Cold War, attention to chemical and**

### **biological weapons was mostly, but not completely,**

### **overshadowed by concerns over nuclear weapons.**

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research and development on both offensive and defensive aspects of biological warfare until President Nixon unilaterally terminated the U.S. offensive program in 1969. Following this decision, the United States and other countries negotiated the Biological Weapons Convention, which prohibits the development, production, and stockpiling of biological weapons. The treaty was concluded in 1972 and ratified by the United States in 1975. Chemical arms control initiatives would not arrive until many years later. After almost two decades of negotiations, the Chemical Weapons Convention was concluded in 1992, and entered into force in 1997.

#### Cold War Chill

**D**uring the Cold War, attention to chemical and biological weapons was mostly, but not completely, overshadowed by concerns over nuclear weapons. The major chemical weapons programs of the

delivery systems, and continue to do so for long periods of time and sustain lethal concentrations, it is impossible to control the battlefield. The United States believed that the Warsaw Pact, and particularly Soviet forces, had the right mix of military capabilities along with the mobility and skill to exploit chemical weapons tactically.

If the Eastern bloc could fight a one-sided chemical war, knowing when and where contamination would occur, its soldiers would have been freed of the burden of wearing cumbersome protective gear that seriously inhibits soldiers' performance. Thus, in the absence of a Western chemical weapons program, the Warsaw Pact was poised to control the battlefield and ultimately win a war with NATO. NATO's chemical weapons stockpile and its inherent threat of retaliation in kind was thought to deprive the Pact of this advantage.

Although chemical weapons were never used in post-war Europe, a few known and suspected cases oc-

curred in other parts of the world following World War II. Egypt is generally believed to have used chemical weapons in the civil war in Yemen in the 1960s, and there is evidence Libya did so in Chad in the 1980s. Allegations of Soviet chemical weapons use in Afghanistan remain controversial. We are

the Soviet Union, President Nixon determined that “biological agents were marginal, if not irrelevant, to a United States equipped with other conventional and nuclear assets and not confronting an imminent military threat.”<sup>9</sup> As a result, he used the decision to abandon the offensive program as leverage in his push

## Illicit Threats

If chemical and biological weapons have been so rarely used in the past—either by states or non-state actors—why is there such concern about these weapons today? Recent events highlight the evolving dimensions of the challenge these weapons present.

For many countries, the Gulf War transformed what was essentially a theoretical issue into a concrete security problem. For the first time, the countries of the coalition against Iraq, including the United States, confronted an adversary known to have a chemical weapons arsenal and suspected of developing biological weapons. In addition, Iraq had demonstrated a willingness to use such weapons. Following the Gulf War, the United Nations Special Commission on Iraq (UNSCOM) made alarming discoveries about the scope and sophistication of the Iraqi chemical and biological weapons program. Iraqi researchers were working on a wide range of chemical and biological agents. The program had progressed to the point that anthrax and botulinum toxin had been loaded into gravity bombs, artillery shells, rockets, and ballistic missiles. The CIA revealed that Iraq could resume production of biological weapons “virtually overnight at facilities that currently produce legitimate items, such as vaccines.”<sup>10</sup> Although it would take longer for Iraq to reconstitute its chemical weapons program than its biological weapons program, Saddam Hussein has not relinquished his pursuit of chemical weapons despite UNSCOM and international sanctions.

Russian President Boris Yeltsin acknowledged in 1992 that the U.S.S.R. ran an illicit and secret offensive biological weapons program for two decades after Moscow signed

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absolutely certain of one major post-war use of chemical weapons: both Iraq and Iran, but especially Iraq, deployed chemical weapons in their war in the 1980s.

During the Cold War, biological weapons, unlike chemical weapons, were not necessarily considered good battlefield weapons. Rather, their role was seen more in strategic terms, as possible weapons against cities or economic infrastructure. The Soviet Union also apparently took a similar view.<sup>7</sup> For the United States, however, with its growing nuclear capabilities, biological weapons were considered redundant.

This was one reason President Nixon decided to end the U.S. offensive biological weapons program in 1969. Some have argued President Nixon thought biological weapons were useless, but that is not the case. Rather, as British expert Gradon Carter has argued, the effectiveness of biological weapons was firmly established. Political, not strategic, considerations drove the decision to abandon the offensive biological weapons program.<sup>8</sup>

Seeking to improve relations with

for an arms control agreement with Moscow.

Despite significant research and development efforts by some countries during the Cold War, there are no documented cases of biological weapons use by states in conflict. But there have been unsubstantiated—some would say discredited—allegations that the United States used biological weapons during the Korean War. Cuba also accused the United States of attacking it with biological weapons in the mid-1990s, a questionable allegation for which Havana has not offered convincing evidence.

Use of chemical and biological agents by non-state actors is also historically rare, and has been limited to attempts at mass poisonings and assassinations. With the significant exception of the Japanese cult Aum Shinrikyo, no non-state actor has conducted a major attack with a chemical or biological weapon that produced large numbers of fatalities. However, law enforcement officials in the United States and in other countries have occasionally captured groups or individuals in possession of such agents.

the 1972 Biological Weapons Convention. The Soviet program represented the most ambitious biological weapons program the world has ever seen, involving dozens of facilities, scores of thousands of people, and billions of rubles. Russian defectors have reported on the program's advanced work in genetic engineering to make agents more resistant to antibiotics, research on nontraditional agents such as Ebola, and large-scale production of smallpox. Media reports on the defectors' revelations fuel lingering U.S. and British concerns that biological weapons programs in Russia have not been completely shut down.

In March 1995, the cult Aum Shinrikyo attacked the Tokyo subway with sarin gas, killing 12 people and injuring more than 500, and the fear of terrorists using chemical or biological weapons became stark reality. Though the cult used the chemical sarin, which is deadly on contact but cannot be spread from person to person, the Aum could, in fact, have chosen biological weapons.

Before the sarin attack, the Aum reportedly made at least nine unsuccessful attempts to dispense anthrax and botulinum toxin in the streets of Tokyo and elsewhere in Japan, including along the perimeter of a U.S. military facility. The cult was consciously committed to recruiting members with scientific and technical backgrounds to help develop chemical and biological weapons, and it had established extensive laboratory facilities for that purpose. It also used international networks to acquire the necessary material and equipment.

Arrests in the United States of people in possession of pathogenic or poisonous agents such as anthrax, ricin, and plague—and a spate of anthrax hoaxes in California; Indi-

ana; Washington, D.C.; and elsewhere—have since exacerbated fears of chemical and biological terrorism.

These few cases illustrate that chemical and biological weapons proliferation is a threat both in terms of international conflict and terrorist activity. U.S. government

achieved, including designing, testing, and building munitions; acquiring effective delivery systems for the munitions; and conducting appropriate logistics, defense planning, and training efforts. Some of these steps are difficult. The most difficult phase of a biological weapons program, for example, is not ac-

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## **Arrests of people possessing pathogens and poisons**

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### **such as anthrax, ricin, and plague have exacerbated**

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### **fears of chemical and biological terrorism.**

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spokesmen generally charge that as many as two dozen nations are pursuing chemical weapons programs of concern, while as many as a dozen are working on biological weapons. Because of the secretive nature of these projects, it is hard to know exactly which countries are actually developing chemical and biological weapons.

A 1993 overview of studies undertaken by several nongovernmental organizations focused on 10 countries suspected of pursuing chemical and five suspected of pursuing biological weapons programs. The past six years have seen few changes in the countries suspected of pursuing chemical and biological weapons proliferation programs, but the U.S. government is most concerned about programs in China, Iran, Iraq, Libya, North Korea, and Syria.<sup>11</sup>

#### **Uncertain Path**

**P**roducing a chemical or biological agent, however, is not the same as developing a weapon. First, many additional steps must be taken before weapons capability is

requiring the agent but engineering a device that disseminates the agent to accomplish the goals of the attack.

Second, when the U.S. government asserts that a state is pursuing a chemical and biological weapons program, intelligence information is not always sufficient to determine the precise status of the program. In the case of Iraq, for example, many analysts were surprised by the scope of Saddam Hussein's biological weapons program and the speed with which it had moved to weaponization. In many cases, we just can't know enough to determine whether a country is a committed proliferator or if it is only a dabbler conducting research on various agents without necessarily having made the decision to go to full-scale production or weaponization.

Third, while various programs may be similar, they are not necessarily identical. For example, there are at least nine different production processes for sulfur mustard.<sup>12</sup> The United States and the Soviet Union produced VX, a nerve gas, through different processes, and Iraq and the United States used dif-

ferent methods to develop G-category agents.<sup>13</sup> Moreover, the biotechnology revolution could open a path for entirely new technologies that were not available in earlier efforts such as the U.S. program in the 1950s. As the Office of Technology Assessment pointed out, each pathway involved tradeoffs among simplicity, speed, agent shelf life, and visibility. The choice of

generally, many of the chemical precursors that could be used in weapons production are commercially used in quantities surpassing millions of tons per year. With respect to biological weapons, much of the equipment and many of the production processes for making weapons differ very little from those used to brew beer, make yogurt, or develop medicines.

facilitate development of another country's chemical or biological weapons programs.

Second, chemical weapons proliferation has been described as an "unfortunate side effect of a process that is otherwise beneficial and anyway impossible to stop: the diffusion of competence in chemistry and chemical technology from the rich to the poor parts of the world."<sup>15</sup> The same can be said of biological weapons. Trade and investment figures underline the extent of the diffusion phenomenon:

- Exports of chemicals from the developed world to developing nations increased from \$33 billion in 1980 to \$57 billion in 1991.

- Annual direct investment in developing countries by U.S. chemical manufacturers more than doubled from \$4 billion in 1983 to \$10 billion in 1993.

- The U.S. share of investment in the chemical industry in developing countries remained a steady 21 percent between 1983 and 1993.

- The number of licenses issued for the export of microorganisms and toxins grew from 90 in 1991 to 531 in 1994, while permits denied barely increased from 1 to 4 in the same period.

- The Centers for Disease Control and Prevention shipped biological reagents to 41 countries in 1994, up from 24 in 1991.<sup>16</sup>

This diffusion of capital and materials in the global market increasingly creates a world of virtual chemical and biological weapons programs in which the critical factor shaping the proliferation landscape is not technical capability, but political choice.

Human expertise adds to the diffusion problem. Experts from countries with a major chemical and biological weapons program are being recruited by other countries inter-

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## **The production processes for making weapons**

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### **differ very little from those used to brew beer,**

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### **make yogurt, or develop medicines.**

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pathway would therefore be affected by the urgency of a country's military requirement, its desire to keep the program secret, its level of concern over worker safety and environmental protection, and the existence of embargoes on precursor materials and production equipment.<sup>14</sup>

Whatever pathway is chosen, however, it is wrong to assume that the paths of the future will be the same as the paths of the past.

#### Taming the Hydra

**H**ow can those responsible for dealing with these threats come to grips with chemical and biological weapons proliferation?

First, since much of the material and equipment in a chemical and biological weapons program is dual use, many agents and much of the equipment used to make them also have legitimate commercial uses. For example, the chemical thiodiglycol, a key precursor for large-scale production of mustard gas, also happens to be a key component of ballpoint-pen ink. More

The international community, which recognizes the problems inherent in dual-use chemical and biological material and equipment, has attempted to impose some regulation of critical precursors and equipment. The 31-member Australia Group, an informal consortium of nations that has agreed to coordinate chemical and biological export controls, is currently under attack from radical nonaligned countries. Iran frequently takes the lead in accusing the Australia Group of discriminating against non-aligned countries and violating the spirit of the Chemical Weapons Convention and the Biological Weapons Convention. These conventions, in addition to banning weapons, also commit parties to share technology and information for peaceful purposes. The United States, on the other hand, often takes the lead in arguing that the Australia Group is indeed consistent with the conventions and also provides a mechanism for implementing the commitment not to transfer equipment or material that could

ested in pursuing such programs. This is especially true for scientists from the former Soviet Union.

In addition, foreign nationals trained in the United States and elsewhere in the West in scientific disciplines such as organic chemistry and microbiology may return home and exploit their knowledge to develop chemical and biological weapons. Certainly, not all foreign students in the hard sciences or engineering are proliferation risks. But experience has demonstrated that foreign-trained nationals often take lead roles in a proliferator's weapons development programs. Iraq, for example, has used scientists educated in the United Kingdom as key players in its chemical and biological weapons programs.

A third challenge is the prospect that new chemical and biological weapons could be developed. Russia has reportedly developed a novel chemical agent called Novichok—which means newcomer—that is alleged to be 10 times more lethal than VX, the deadliest known nerve gas.<sup>17</sup> And the biotechnology revolution could lead to new weapons that capitalize on genetic engineering, including the prospect of weapons targeted against specific ethnic groups.<sup>18</sup>

Finally, the legacy of the Cold War has shaped current thinking about the threat posed by chemical weapons. Thinking in such terms of limited Cold War scenarios today is too narrow.<sup>19</sup> In major wars, chemical and biological weapons have a broader range of uses than has generally been appreciated. Their use may be threatened, for example, to dissuade national leaders from initiating military action or to deter intervention by an outside state or coalition before actual military conflict begins. Chemical and biological weapons may also be employed to cripple an intervention in its early

stages and prevent the conflict from progressing to a decisive encounter. Other uses include psychological intimidation or instilling panic in civilian populations. Forces defeated on the battlefield may also resort to chemical or biological weapons to turn their defeat into a victory by making the territory lethal to humans, thus severely limiting the victor's freedom of action.

#### A New Line of Defense

Increasing U.S. dependence on force projection—a military strategy for faraway places that counts on superior air power, naval forces, and smart bombs followed by the rapid introduction of ground troops—makes the United States particularly vulnerable to these broader chemical and biological weapons attacks. On the basis of war games and other analyses, one government study noted that force projection-style military operations are vulnerable to delays and disruptions, if not total failure, if even small amounts of chemical and biological weapons are used to attack the deployment sites.<sup>20</sup>

Major theater wars, however, are not the most likely conflict situations in which U.S. forces will find themselves in the future. Rather, lower-scale conflicts—such as peace enforcement operations, humanitarian assistance missions, or noncombatant evacuations—are more likely scenarios. Threatening to use chemical weapons to force U.S. troops out of the territory in such situations is one possible contingency. Another scenario is using chemical and biological weapons to target crowds of civilians preparing for evacuation. Policymakers and defense planners have paid almost no attention to confronting chemical and biological weapons use in such scenarios. That situation must change.

Post-Cold War security dynam-

ics may change how we calculate the costs and benefits of developing, acquiring, and exploiting chemical and biological weapons. The growing attraction of asymmetrical strategies used by weaker countries against the strong, or even civilian targets, and the emergence of new terrorist entities are but a small part of this changing environment.

The diffusion of chemical and biological materials, equipment, and expertise is breaking down technical barriers to chemical and biological weapons proliferation. Since the end of the Cold War, the ways of engaging in conflict have diversified, multiplying the potential uses of chemical and biological weapons.

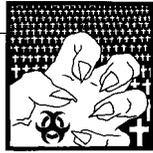
The challenge, however, remains much the same: to convince decision makers who may contemplate acquiring chemical and biological weapons that the consequences of taking that step are too great. Raising the costs of buying, developing, or using chemical and biological weapons as high as possible will require a panoply of policy tools. Curbing the spread of these weapons will require more vigilant intelligence, stricter arms control and export controls, stepped-up diplomacy, and the threat of punishment for offending actors. The international community must work together to find an effective strategic approach to end proliferation. ■

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# Grave New World

*The United States may be overrating the threat of terrorism,  
which remains a weapon of the weak.*

BY PETER CHALK

**T**errorism traces a history at least as old as the revolutionary anarchist movement that swept across Europe during the 19th century. However, only in the last decade, and particularly the last five years, has the United States prepared to focus on terrorism as a serious challenge to national security and the stability of the international system. When President Clinton addressed the United Nations in October 1998, he identified terrorism as one of Washington's chief security challenges for the 21st century and portrayed the issue as one that must "be at the very top of the world's agenda."<sup>1</sup>

America's concern with this mode of violence is growing for three reasons. First, terrorist attacks have become more lethal and effective during the 1990s, and the number of

casualties and fatalities per incident is greater than at any other time in the past. Second, the growing sophistication of modern industrial society has created a slew of cyber-based information systems that are conceivably flexible enough to provide an alternative medium of conflict for those wishing to engage in critical attacks on the infrastructure. Third, the increased incidence and severity of terrorist events within the United States has radically altered Washington's perception of the threat, which has historically been focused on risks to American nationals and facilities abroad.

In spite of these developments, much of the current analysis in the country, particularly at the domestic level, is at odds with the realities of terrorist behavior and operations. Weak analysis results in poor policymaking and an inability to prioritize responses to terrorist threats.

## Growing Lethality

During the 1970s and 1980s, analysts proclaimed with confidence that "simply killing a lot of people has seldom been a terrorist objective."<sup>2</sup> According to conventional wisdom, terrorism sought to change the world through highly visible but ultimately symbolic acts of political violence. Today, however, many terrorists are no longer prepared to draw the line at limited, restricted acts of violence. Instead, their actions have become progressively more extreme and bloody, with indiscriminate killing being more the rule now than the exception.<sup>3</sup>

Three main factors account for terrorism's heightened lethality during the 1990s. First, an increase in religious extremism, resulting from the perceived failure of secular regimes and governments, has led to a proliferation of groups that uphold Manichean objectives couched in absolute terms of good and evil and regard whole segments of society as the major target of their campaigns of violence.<sup>4</sup>

Second, developments in information technology have led to the organizational restructuring of terrorist movements, whereby members no longer recruit and act together physically but communicate through the global information grid. This has led to a relaxing of group constraints on committing mass, indiscriminate murder, with members increasingly justifying their actions on purely individual moral planes.<sup>5</sup>

Finally, the proliferation of combat weaponry from Eastern Europe and former Cold War conflict zones has markedly escalated the violence threshold of terrorists, making attacks more lethal and sophisticated than before.<sup>6</sup>

The increased lethality of terrorism has affected threat perceptions

in the United States in two main ways. First, it has reinforced the notion that terrorism, far from being made obsolete by the end of the Cold War, is in fact escalating and becoming even more complex and dangerous. The increased severity of lethal attacks has given rise to concern that more U.S. citizens and facilities overseas will be targeted as terrorist organizations react with increasing violence to the United States, which both defines itself and is widely recognized as the leader of the Western world. The fear of Islamic attacks has been especially prominent. Indeed, in 1995, Philip Wilcox, the State Department's coordinator for counterterrorism, portrayed Islamic extremism as the most dynamic phenomenon in contemporary international terrorism because groups and individuals are increasingly willing to strike aggressively at the United States and other targets outside the fundamentalist Muslim world.<sup>7</sup>

The 1996 Khobar Towers bombing in Saudi Arabia and the 1998 Kenyan and Tanzanian embassy attacks significantly galvanized the perception of these threats, with policymakers repeatedly referring to an alleged Islamic terrorist conspiracy aimed specifically at the United States and its allies. Reflecting this is the massive federal case that U.S. law enforcement and intelligence authorities have been building against Osama bin Laden. The U.S. Attorney's Office now openly accuses bin Laden of leading and coordinating al-Qaeda—a global terrorist organization dedicated to the “murder of U.S. nationals anywhere in the world.”<sup>8</sup>

Meanwhile, the increased severity of attacks has radically altered perceptions of the potential threat of chemical, biological, radiological, and nuclear (CBRN) terrorism.

During the Cold War years, it was assumed that terrorists were essentially rational actors who clearly understood that to use such agents would undermine national and international political support for their cause. Further, since using CBRN agents would inevitably attract massive state reprisal, it was presumed that terrorists would be logically deterred from crossing the threshold of mass destruction.

During the 1990s, however, and particularly since the 1995 Aum Shinrikyo sarin nerve gas attack in Tokyo, there has been a major shift in U.S. thinking about this conventional wisdom. Senior White House and State Department officials, Congressional leaders, and intelligence officials now routinely refer to mass destruction terrorism as a distinct possibility and appear to believe that escalation to this level is inevitable.<sup>9</sup>

A number of factors have contributed to this altered mindset, among them reports that Russian chemical, biological, and nuclear scientists are free-lancing for rogue states and terrorist groups. The proliferation of CBRN technology and the presumed precedent set by Aum's 1995 sarin attack have also increased awareness of the potential threat. However, it is the heightened lethality of terrorism that has been, arguably, of most importance. In particular, it has forced attention on a new type of terrorist adversary willing to gain an unconventional capacity. As Secretary of Defense William Cohen forcefully stated in a *Washington Post* op-ed in 1999:

These [CBRN] terror weapons will find their way into the hands of individuals and independent groups—fanatical terrorists and religious zealots beyond our bor-

ders.... Welcome to the grave New World of terrorism—a world in which traditional notions of deterrence [and rationality] no longer apply.... We are preparing for the possibility of a chemical or biological attack on American soil because we must. There is not a moment to lose.<sup>10</sup>

#### Achilles Web

Modern industrial society increasingly relies on critical infrastructure and cyber-based information systems essential to the basic functioning of government, society, and the economy. These include telecommunications, energy, banking, transportation, finance, water systems, and emergency services both governmental and private. Historically, many of these infrastructures existed as physically and logically separate systems that had little to do with one another. Due to advances in information technology and the necessity for improved efficiency, however, these infrastructures have become increasingly automated and interconnected, effectively moving many national assets into the virtual world of cyberspace. These electrical distribution networks, operationally known as Supervisory Control and Data Acquisition (SCADA) systems, constitute the nerve centers for much of what animates modern high-tech society, from air traffic control to banking.<sup>11</sup>

These fully interlinked networks depend on a capacity for constant, dense information and communications flow. Modern innovations such as cellular telephones, fax machines, electronic mail, World Wide Web sites, and computer conferencing facilities support this requirement. In a wired society, a large percentage of governmental and private work takes place online, with single nodes having vir-

tual instantaneous access to many others. A terrorist could theoretically, without leaving the home base, launch an electronic attack against infrastructure targets from thousands of miles away, plunging a country into chaos. Acting in this way, a perpetrator could crash entire networks upon which most modern information infrastructure depends; alter, steal, or destroy vital national security, financial, and record-keeping systems; or sabotage specific corporate, transportation, medical, and educational networks.<sup>12</sup>

These developments have sparked growing concern within the U.S. security community over the threat of cyberterrorism. The destructive effect of this type of political violence, if correctly harnessed and directed, could be exponentially greater than even that wielded by lethal biological and chemical weapons. Indeed, one senior Federal Bureau of Investigation official has suggested that 20 capable hackers backed with US\$1 billion in financial aid could effectively shut down the entire country.<sup>13</sup>

The fear of this type of terrorism has been further driven by powerful encryption software and coding devices that potentially allow terrorists to execute largely untraceable electronic attacks with near anonymity. Extremists could conceivably work in relative safety from almost any country in the world—including the United States—if they had access to the necessary telecommunications infrastructure. Analysts from the intelligence community have additionally warned that if terrorists are careful about changing their pattern of attacks and regularly destroy any computerized evidence that could be used to implicate them, tracing by law enforcement authorities would be virtually impossible.<sup>14</sup>

While no major attacks have, as yet, been directed against U.S. facilities, a number of minor instances have reinforced the cyberterror fear. The FBI has confirmed, for instance, that intruders have already penetrated computers belonging to the Defense Department, other government agencies, and private contractors. These hackers have stolen unclassified but still sensitive technical information about essential defense research matters. The FBI is currently handling over 800 cases of computer-related crime, ranging from vandalism of websites to the potential theft of military secrets.<sup>15</sup>

Electronic attacks against foreign governments have further underscored the perceived threat to America. One of the most serious instances occurred in 1997 when a “cybersuicide attack” organized by the Liberation Tigers of Tamil Eelam in Sri Lanka successfully crashed the internal email systems of Colombo’s diplomatic missions in Ottawa, Washington, and Seoul. The operation—carried out by the Internet Black Tigers—was the first known assault by a terrorist organization on a target country’s computer systems. Although the cyberstrike amounted to little more than a bid to swamp Sri Lanka’s consulates with electronic mail, it did, in the words of a senior U.S. official, “cause us to sit up and take notice. It was the first terrorist attack of its kind and represented a portent of things to come.”<sup>16</sup>

#### Terrorism Within

Although the United States has been a target of terrorism for many years, most attacks during the 1970s and 1980s were carried out against citizens and facilities abroad. This has changed during the 1990s, with several high profile assaults perpetrated directly on American soil, includ-

ing the World Trade Center bombing in 1993, the Oklahoma City bombing in 1995, and the Atlanta Olympic Park bombing in 1996. These attacks have underscored the fact that the United States is not immune from acts of terrorism. The Oklahoma City bombing further demonstrated that highly destructive assaults can just as easily come from U.S. citizens as from foreign nationals. The attack remains one of the most lethal acts of terrorism carried out in the modern age.

The threat of homegrown terrorism has also been reinforced by the increasingly active nature of U.S.-based, ad hoc, amateur extremists. Loosely networked right wing extremists—including militia groups, the Christian Identity movement, survivalists, xenophobics, isolationists, anti-Semites and neo-Nazis—have grown markedly. Total membership in such groups may exceed 5 million people.<sup>17</sup>

The prominence of radical groups that champion the causes of animal rights, environmentalism, and anti-abortion has been just as important. Several of these demonstrate a very definite penchant for violence, adopting the same type of extremism characteristic of fundamentalist religious organizations. Groups such as Earth First!, for example, have affirmed they are willing to use any tactics, including political violence, to achieve their goals.<sup>18</sup>

While radical groups within the United States are not a new phenomenon, the increasingly decentralized and diffuse nature of these organizations is. Many rely on information-based media such as the Internet to communicate, recruit, and act, giving them an amorphous, ephemeral, and largely leaderless character.<sup>19</sup> In fact, the stealthy growth of the U.S. militia movement, largely unobserved by govern-

ment and law enforcement agencies until recently, has been made possible in large part by new technologies that allow groups to communicate in a more covert and defensive fashion.<sup>20</sup>

Further complicating the situation were fears about the new millennium, which could have been used by American extremists as a call to arms. These fears were the impetus for the FBI's *Project Megiddo*, an intelligence initiative aimed at assessing the potential for U.S. domestic terrorism both before and after January 1, 2000. The 1999 report found evidence that members of certain extremist groups were raising funds fraudulently; stockpiling food, weapons, and other supplies in safe houses; recruiting new members; and selecting potential targets for attack.<sup>21</sup>

The growing incidence and unpredictability of terrorist acts, whether by transnational Islamic zealots or homegrown radicals, has fed increasingly dire and exotic forecasts focusing typically on mass cyber, chemical, or biological attacks, which policymakers now seem to assume are not a matter of if, but when. As perceptions of the internal terrorist threat to the United States have risen so too has confidence declined in the country's ability to prepare and organize defensive action. Government, law enforcement, and intelligence personnel now routinely emphasize U.S. vulnerability to massive infrastructural, chemical, and biological attacks in official briefs as well as through wider releases of warnings to the media. Officials also underscore the difficulty of countering the activities of transient, ad hoc organizations linked through information technology, especially since leaderless networks can operate in a largely secure environment.

## U.S. Responses

Washington's growing concern with terrorism during the 1990s has resulted in a variety of legislative acts, foreign policy decisions, and organizational initiatives. At the international level, economic, military, and diplomatic instruments have been aimed against states suspected of harboring or otherwise aiding anti-U.S. terrorists. Following the 1998 bombings of its embassies in Kenya and Tanzania, for instance, Washington launched punitive missile attacks against Afghanistan and Sudan on the grounds that both states played an integral role in supporting the twin assaults.<sup>22</sup> Half a year later, the Clinton administration specifically asserted the right to bomb government facilities of any state known or suspected of providing sanctuary to international terrorists.<sup>23</sup> Economic and diplomatic embargoes have also been imposed on regimes such as Libya and Iran deemed to be terrorist sponsors. In one especially controversial move in 1996, Congress passed the Iran-Libyan Sanctions Act, which targeted any overseas venture that invested more than US\$40 million annually in the oil and gas sectors of either country.<sup>24</sup>

Domestically, Washington has increasingly emphasized internal preparedness, particularly against cyber and CBRN attacks. Law enforcement authorities have repeatedly attempted to legitimate the covert installation of devices that override encryption programs designed to protect personal and proprietary information.<sup>25</sup> While such measures have yet to be endorsed, Congress has proposed a system designed to track and analyze suspicious activity on sensitive computers. Known as the Federal Intrusion Detection Network, or FIDNET, the system will also be used to train experts at

each federal agency on how to identify and counter unsanctioned computer intrusions.<sup>26</sup>

Equally as indicative is Presidential Decision Directive 63 (1998), which is specifically designed to protect critical infrastructure. The directive designates eight physical and cyber-based systems deemed essential to the minimum operations of the economy and government and considered vulnerable to possible terrorist attack or other forms of deliberate disruption.<sup>27</sup> Responsibility for safeguarding these various sectors rests in the hands of the National Infrastructure Protection Center, a body designed to act as a centralized focal point for infrastructural threat analysis, information gathering, and attack-consequence management. The Center includes FBI investigators experienced in computer crimes and infrastructure protection, as well as representatives from the Department of Defense, the intelligence community, and lead federal agencies for information, banking, water supply, transport, electric power, emergency services, and public health.<sup>28</sup>

Presidential directives, acts of Congress, and organizational initiatives have also been a fundamental feature of efforts to counter CBRN attacks. Prominent examples include:

- Presidential Decision Directive 39 (1995), which subdivides areas of responsibility for dealing with acts of terrorism within the United States into two distinct categories: crisis management and consequence management. The FBI is the lead agency for crisis management; the Federal Emergency Management Agency is lead for consequence management.<sup>29</sup>
- The Defense against Weapons of Mass Destruction Act of 1996, otherwise known as the Nunn-Lugar-Domenici Act. This focuses on programs designed to enhance pre-

paredness against weapons of mass destruction for state and local emergency agencies. A National Domestic Preparedness Office, due to be fully operational by the end of 2000, has also been created to act as a focal point for this training and a clearinghouse for additional information, assistance, and support.<sup>30</sup>

■ The creation of three special National Security Council groups with responsibility for overall U.S. counter-terrorism policy, including the Weapons of Mass Destruction Preparedness Group, the Counter-Terrorism Security Group, and the Critical Infrastructure Protection Group.<sup>31</sup>

■ The creation of a new Counter-Terrorism Division within the FBI, which will include both the National Infrastructure Protection Center and the National Domestic Preparedness Office, as well as a separate Investigative Services Division to encourage information sharing and coordination between analysts and senior officials working in separate FBI units.<sup>32</sup>

These and other efforts have caused the antiterrorism budget to balloon over the past five years. In fiscal year 1996, for example, \$5.7 billion was spent by the main federal agencies involved in counter-terrorism activities. For fiscal year 2000, the president requested \$10 billion to be devoted to counter-terrorism efforts and programs, almost double the 1996 allocations and nearly \$3 billion more than the sum originally required for 1999.<sup>33</sup> Budgetary increases for key individual agencies have been even greater. As a case in point, the Department of Health, has requested \$230 million for its bioterrorism activities in fiscal year 2000. This represents a 3,000 percent increase over the \$7 million in 1996.<sup>34</sup> The FBI's anti-terrorism budget has also increased

dramatically, more than tripling in the last three years alone.<sup>35</sup>

#### Assessing the Response

Despite these numerous legislative initiatives, new programs, and financial allocation, the overall U.S. response to terrorism remains problematic. At the international level, use of sanctions and other economic restrictions have complicated America's relations with key allies, and a number of European governments have criticized efforts to block trade with so-called pariah regimes as little more than extraterritorial bullying. Following the 1996 Iran-Libya Sanctions Act, for instance, French President Jacques Chirac publicly threatened the United States with retaliatory action if any move was made to block commercial agreements made by French oil corporations wishing to do business with either Teheran or Tripoli. The following year, in direct violation of the act, a US\$2 billion development deal was struck between the National Iranian Oil Corporation and a consortium of French, Malaysian, and Russian business interests. Months of intensive diplomatic haggling between Paris and Washington eventually ended in a humiliating U.S. backdown. The Clinton administration acknowledged in 1998 that sanctions would not only be waived in this instance but that future commercial ventures would also be assessed on a case-by-case basis.<sup>36</sup>

In general, economic measures have proved remarkably ineffective in pressuring alleged state sponsors of terrorism to renounce their behavior publicly. Even seasoned U.S. government counter-terrorism experts now question the usefulness of trade embargoes as an instrument of coercion. (See "The Costly Remedy" in this issue of FORUM.)

It took nearly eight years, for example, for Libya's Qaddafi to hand over the two intelligence officers reputedly responsible for the 1988 Pan Am flight 103/Lockerbie bombing.<sup>37</sup> Indeed, the critical ingredient that finally led to the extradition of the two agents in 1999 may have had less to do with tough U.S. economic posturing than with efforts by other governments to engage Tripoli in critical and constructive dialogue.

Military retaliation has been equally as controversial and ineffective. Consider the missile attacks that were launched against Sudan and Afghanistan in the wake of the 1998 U.S. embassy bombings in Kenya and Tanzania. The strikes raised serious questions about the legitimacy of the overall American counter-terrorist response, and many criticized Washington for failing to ensure that reprisals were taken only on the basis of hard, substantiated evidence.<sup>38</sup> Moreover, the attacks not only failed to find their mark in bin Laden's Afghan operational heart, they served to lionize both him and his cause, fueling fundamentalist resentment throughout Southwest Asia and, indeed, most of the Islamic world.<sup>39</sup> Military responses such as these create irreversible effects and almost certainly result in calls for revenge, allowing extremists and hard-liners to forge unity out of diversity. As one anti-terrorist expert has somewhat cynically remarked, "When you cannot kill them all, don't kill any of them; they will [only] come back stronger."<sup>40</sup>

#### Risk-free Nation

It is domestically, however, where most problems arise, largely because governmental concern has concentrated on possibilities, not experience. This has led to a proliferation of ambitious initiatives that bear

little resemblance to the type of contingencies the United States is most likely to face.

Nowhere has this been more apparent than with the current preoccupation with CBRN terrorism. Not only has there been a tendency to lump these agents together, in spite of significant differences in the ways they might be employed, there has also been an assumption that their use is inevitable and that when this occurs, the results will be catastrophic.<sup>41</sup>

Such assessments, however, ignore terrorism's track record, which shows an overwhelming preference for the gun and the bomb, the effects of which are well-known. They also fail to appreciate the very real technical obstacles in deploying CBRN agents, barriers that are particularly formidable for those trying to inflict mass casualties. The fact that the Aum cult failed in its bid to cause numerous fatalities in the 1995 Tokyo subway attack—where 12 people died—despite the group's extensive financial and scientific resources, would appear instructive in this regard.

Future CBRN attacks would likely be launched in a limited and discreet manner, designed to elicit mass panic rather than cause mass damage. However, the U.S. CBRN response containment system is based on worst-case scenarios emphasizing assaults with high consequences as opposed to small-scale, incapacitating attacks. The guiding assumption has been that these are a lesser contingency that can easily be dealt with in preparations for mass casualty attacks.

This reasoning is by no means axiomatic. Contingency planning for small-scale events will more likely require a state and local response, rather than strong, centralized federal action.<sup>42</sup> Moreover, the

emphasis on preparing for massive attacks is an inefficient way to set budgetary priorities and allocate resources and could actually detract from security.<sup>43</sup> U.S. Assistant Comptroller General Henry Hinton made this very point before Congress in 1999 when he testified that “the United States cannot fund all the possibilities that have dire consequences. By focusing investments on worst-case possibilities, the government may be missing the more likely threat the country will face.”<sup>44</sup>

Assessments of cyberterrorism have been equally problematic. While it may be theoretically possible to launch a crippling infrastructural network attack within the United States, actually achieving this undoubtedly remains beyond the capabilities of known terrorist groups. The most sophisticated cyberattack to date by the Internet Black Tigers merely overloaded Sri Lankan government email servers. It's also worth pointing out that past attacks on the infrastructure have always been executed with conventional explosives, such as the IRA's attack on London's financial district in 1992. There is nothing to indicate that this is about to change, particularly given the added complexities of employing cyber-based tactics.

#### Gaining Perspective

In the 1990s, the United States has overrated the strategic and political impact of terrorism. This has resulted in policies that appear heavy-handed and disproportionately weighted to worst-case scenarios at the expense of planning for less expensive but arguably more likely threats. The potential threat has been exaggerated in part because of a poor understanding of the historical phenomenon of terrorism, something that has been further encour-

aged by the popularity of literary interpretations of political violence by authors such as Tom Clancy and Richard Preston. In addition, there has been a tendency to confuse limited, privately funded operations with legitimate concerns about foreign aggression employing weapons of mass destruction or cyber-terrorism.

The current American obsession with a risk-free society has also driven the trend toward exaggerating large-scale terrorist attacks. The country's preoccupation—some would say fixation—with terrorism is very much part of this mindset, producing analyses that perpetually obfuscate credible threats with potential vulnerabilities.

While terrorism does appear to have become lethal and less predictable in recent years, it essentially remains a weapon of the weak and, despite some horrific, sporadic attacks, is not a significant national security threat. It is time to put some perspective on the terrorism debate in the United States and avoid the type of fact-free anxieties and arguments that may be “dramatic [and] emotionally powerful, but are analytically feeble.”<sup>45</sup> ■

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5. See, for instance, Bruce Hoffman, *Terrorism and Weapons of Mass Destruction: An Analysis of Trends and Motivations* (Santa Monica: RAND Corporation, 1999), pp. 35-7. Perhaps the clearest indication of this was the 1995 bombing of the Alfred Murrah Federal Building in Oklahoma City, the most destructive act of terrorism ever carried out on U.S. soil. Principally orchestrated by Timothy McVeigh and Terry Nichols, who used explosives constructed from homemade C4 plastic explosive books, the attack claimed the lives of 168 people and injured 500 more. Although a definitive rationale for the atrocity has yet to emerge, it is clear that inspiration for the bombing drew significantly on anti-government, anti-internationalist sentiments reminiscent of a number of small, loosely connected U.S. underground militia movements.

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21. *Project Megiddo, Strategic Assessment of the Potential for Domestic Terrorism in the United States Undertaken in Anticipation of or Response to the Arrival of the New Millennium* (Washington, DC: Federal Bureau of Investigation, 1999), p. 4.

22. See, for instance, "US Missiles Pound Targets in Afghanistan, Sudan," *CNN Interactive World Wide News* (August 21, 1998).

23. "US Asserts Right to Bomb Regimes that Harbor Terrorists," *CNN Interactive World Wide News* (February 7, 1999).

24. See, for instance, Bruce Hoffman, "Is Europe Soft on Terrorism?" *Foreign Policy* (Summer 1999), p. 68; "Chirac Warns of Retaliation for US Sanctions on Libya, Iran," *The Australian* (August 8, 1996); and

"Republicans Call for Strikes against Iran," *The Australian* (August 6, 1996).

25. "Justice Dept. Pushes for Power to Unlock PC Security Systems," *Washington Post* (August 21, 1999).

26. See "Computer Security Proposal Is Revised," *Washington Post* (September 22, 1999). US\$8.4 million has been set aside to finance FIDNET.

27. These include banking and finance; transportation; electricity, gas and oil; telecommunications; emergency law enforcement; government services; emergency fire; public health service; and water supply.

28. White House, Presidential Decision Directive 68 (April 1999), pp. 9-10.

29. White House, Presidential Decision Directive 39: "U.S. Policy on Counter-Terrorism" (June 21, 1995).

30. Public Law 104-201, National Defense Authorization Act for Fiscal Year 1997, Title XIV—Defense against Weapons of Mass Destruction (September 23, 1996).

31. Personal correspondence between author and RAND officials (Washington, DC, November 1999).

32. "FBI to Restructure, Adding Emphasis on Crime Prevention," *Washington Post* (November 11, 1999).

33. Henry J. Hinton Jr., Assistant Comptroller General, National Security and International Affairs Division, US General Accounting Office, statement made before the Subcommittee on National Security, Veteran Affairs and International Relations, Committee on Government Reform, US House of Representatives, "Combating Terrorism: Observation on Federal Spending to Combat Terrorism" (March 11, 1999), pp. 1, 6.

34. *Ibid.*, p. 7. The increased funds are to provide for expanded disease surveillance programs, improvements in communications capabilities, and establishment of regional laboratories.

35. "US Spends US\$10 Billion to Fight Bioterrorism Threat," *Lincoln Journal Star* (November 16, 1999).

36. Hoffman, "Is Europe Soft on Terrorism?" pp. 68-70; "Chirac Warns of Retaliation for US Sanctions on Libya, Iran," *The Australian* (August 8, 1996). Following the

announcement of the Iran-Libya Sanctions Act, the European Union also announced that it was modifying draft "blocking" legislation, originally enacted to counteract the Helms-Burton Act (which penalizes investment in Cuba) as a retaliatory measure.

37. Hoffman, "Is Europe Soft on Terrorism?" p. 74.

38. Since the bombings, several questions have been raised regarding the accuracy of intelligence reports relating to alleged chemical weapons production at the El Shifa pharmaceutical plant, one of the principal targets in the Sudanese strikes. See, for instance, "US Wasn't Sure Plant Had Nerve Gas Role," *Washington Post* (August 21, 1999).

39. Peter Chalk, "How Not to Respond to Terrorism," Op-Ed, *The Globe and Mail* (August 27, 1998).

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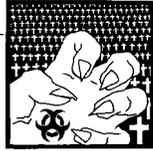
41. For a succinct overview of the various characteristics and accessibility of CBRN weapons, see Richard Falkenrath, "Confronting Nuclear, Biological and Chemical Terrorism," *Survival* 40 (3) (1998), pp. 45-48; and Richard Falkenrath, Robert Newman, and Bradley Thayer, *America's Achilles Heel: Nuclear, Biological and Chemical Terrorism and Covert Attack* (Cambridge, MA: MIT Press, 1998).

42. See, for instance, *First Annual Report to the President and Congress of the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction, I. Assessing the Threat* (December 15, 1999), p. 20.

43. *Ibid*, p. 36.

44. Hinton, "Combating Terrorism: Observation on Federal Spending to Combat Terrorism."

45. Brian Jenkins, testimony before the Congressional Subcommittee on National Security, Veterans Affairs and International Relations, Committee on Government Reform, US House of Representatives, Washington, DC (October 20, 1999).



# The Costly Remedy

*Support for sanctions enforcement must not compromise overall military preparedness.*

BY BERNARD F. GRIFFARD

America's affinity for economic sanctions evolved from the human price paid to advance foreign policy by military means in World War I. Since 1918, strategists have sought to wield the economic instrument of power to achieve an international environment that enhances security, bolsters economic prosperity, and promotes worldwide growth of democratic processes. During the Cold War, use of economic sanctions was selective and success spotty. Since the collapse of the Soviet Union, however, the United States has shown little reluctance to use its position as the world's leading economy and sole superpower to threaten or impose economic sanctions to advance its foreign policy agenda.<sup>1</sup>

Even though the limited effectiveness of economic sanctions is

well documented, enthusiasm for their use remains popular in our highly competitive, results-oriented society.<sup>2</sup> Rationale for this enthusiasm, however, is hard to trace in a world where tyrants exhibit little concern for their citizens, who often bear the brunt of sanctions. The argument proposed by Woodrow Wilson in 1919, that economic sanctions are an economic, peaceful, silent, deadly remedy, has little credibility today. While economic sanctions may be seen as an inexpensive way to pursue an activist foreign policy, this is a serious miscalculation. In fact, sanctions use is and will continue to be a serious drain on the readiness and resources of our armed forces.

## Policy Considerations

Economic sanctions are long-duration operations that exclude a target nation from free intercourse at

the international level. To remain effective over the long term, sanctions require a readiness to employ a number of enforcement tools including military capabilities and forces. By weakening the economy and limiting access to essential commodities, capital, research, and technical education, sanctions are intended to deny the sanctioned entity a military option to end its exclusion.

The challenge for U.S. policymakers is that the only remaining military superpower is not as "super" as it was in 1990, and the calculus of coercive diplomacy to influence the policies of other nations isn't what it used to be. The United States and the former Soviet Union no longer threaten mutual annihilation, and as the recent Kosovo experience demonstrated, the current terms of military engagement favor limited use of air strikes over large-scale deployment of ground forces to influence the policies of other nations.<sup>3</sup> Congress and the U.S. military leadership are currently questioning the readiness and capability of the armed forces to reinforce economic sanctions with decisive military action if the desired goals are not achieved.<sup>4</sup>

Since the fall of the Berlin Wall, U.S. military forces have increased the tempo of their operations through sanctions, as well as military actions such as Desert Storm and in Haiti and Kosovo. At the same time, the military has absorbed massive reductions in resources and personnel. The increased demands on the military are in large part due to the inability of foreign policy executors to define an end state or exit strategy for many of their engagement activities. This demonstrated inability to efficiently plan for the use of military capabilities when designing sanctions re-

gimes has made them a major consumer of military resources. For example, incremental costs incurred for Department of Defense contingency operations from fiscal year 1991 to 1996 were over \$64 billion. Of that amount, approximately \$4 billion to \$5 billion was spent on sanctions regimes.<sup>5</sup>

Harry Summers, nationally syndicated military affairs analyst, describes how sanctions, when they are effective, can create an unstable condition that may require remediation through military means.

As the noose tightens on a state's economy, the victim may pursue a highly risky course of action... that otherwise would not have been hazarded.... With the proliferation of chemical, biological, and nuclear weapons, any such escalation could be highly problematic, if not outright dangerous.<sup>6</sup>

For sanctions to be a credible tool when U.S. national interests are at stake, they must be backed up by a plan to use military power to ensure success if necessary. To accomplish this, sanctions may require three kinds of military support in escalating degrees of cost and impact on force readiness:

- Contingency planning for possible military or humanitarian intervention if goals are not met or the citizens are in jeopardy.
- Planning for unforeseen, secondary effects such as ethnic cleansing, migration, or asymmetric information attacks, and for technical and military support to maximize U.S. policy gains.
- Enforcing embargoes and exclusion zones with selective and limited employment of military forces.

When sanctions are applied without such backup plans, they may cause significant military costs in

spite of the perceived weakness of the targeted nation. The relatively small and powerless countries of Haiti and Cuba, for example, have proven the difficulty of using sanctions to achieve political or diplomatic goals.

#### Planning Ahead

Contingency planning looks ahead to decide whether military intervention will be needed, should sanctions produce a humanitarian crisis or an unreasonable action such as the Serbian government's acceleration of the ethnic cleansing process in Kosovo. However, humanitarian crises may or may not spur an intervention, depending on how the public perceives the situation.

U.S. policy in Haiti, a country plagued by political turmoil and humanitarian suffering for decades, has been one of intervention and occupation followed by periods of benign neglect.<sup>7</sup> Over the past decade, for example, the level of interest in a series of political crises in Haiti has depended on the CNN factor and the political climate of the time. In evolving international situations, moreover, the level of national interest can be a moving target, depending on the media's focus.

John Stremlau at the University of Witwatersrand in Johannesburg, South Africa, has noted how these factors can affect U. S. policymakers. In September 1994, the United States led a multinational intervention to oust the military junta that had been in control of Haiti since 1991. The humanitarian crisis was in part due to the failure of U.S.-enforced sanctions, in place since the ouster of President Jean-Bertrand Aristide.

The plight of the innocent in Haiti posed special problems for the U.S.... Media reports that the

country's desperately poor were at acute risk gained instant credibility.... The impact of these news reports on American and international public opinion...may have contributed to Washington's willingness to move ahead with more forceful measures.<sup>8</sup>

This chain of events illustrates a lesson for U.S. foreign policy: when a sanctions response is recommended, it is in the United States' best interest that the objective be clearly defined and achievable through enforcement actions. When the objective is not clearly defined or is overly ambitious, sanctions are less effective or result in unforeseen reactions from the targeted state. When considering the aims of a sanctions regime, and whether those aims are enforceable, the military planner doesn't ask, "Is there a light at the end of the tunnel?" but rather, "Does this tunnel really have an exit, and can I get to it?" This leads to another key planning concern: credibility of the sanctions regime.

Credibility requires that those who impose sanctions exhibit a will to stay the course until their goals are achieved. The sanctioned nation must perceive that its failure to desist in its violation of international law will result in only one outcome: continued economic hardship. The United States, in its enthusiasm to punish the Haitian junta, lost sight of the embargo's primary goal: the restoration of the democratically elected government. This created pressures for outward migration and the subsequent media interest.

Military leaders should not underestimate the power of public opinion and of media influence on public responses to political and humanitarian crises. Normally, the lower the level of national interest and political concern, the greater

the patience to achieve an end state through sanctions alone, without military intervention. However, increased media coverage tends to increase the likelihood of a military intervention, as in Somalia, Haiti, and Kosovo.

#### The Emigration Card

As a foreign policy tool, sanctions are truncheons rather than precision-guided munitions. The secondary effects of sanctions, which include short-term humanitarian consequences such as malnutrition and disease among civilian populations and longer-term structural impacts, such as the degradation of the economic infrastructure and the economic collapse of the middle class, threaten any political gains.

Cuba and Haiti provide excellent examples of this problem. In these Caribbean nations, the effectiveness of sanctions, coupled with the existing basic weaknesses of their economies, resulted in extreme deprivation among the citizens. Although the Cuban and Haitian leadership rarely suffered, growing hardships forced them to take action to relieve building internal pressures. Cuba's Fidel Castro and Haiti's former military strongman Lieutenant General Raoul Cedras, however, had no intention of meeting U.S. demands for democratization, nor were they able to respond militarily with their limited means. With no legitimate military course of action, they found an opportunity to use an asymmetrical attack against the United States: Castro and Cedras employed the migration weapon, a highly effective, low-cost method of international extortion.

When President Aristide was ousted in September 1991, the Organization of American States imposed sanctions on Haiti to coerce the junta into restoring the demo-

cratically elected government. Although the embargo blocked the import of piece goods vital to the maintenance of the Haitian dry goods assembly industry and devastated most progress Haiti had made towards modernization, it failed to force the leadership to change its policy of torture and political assassination.<sup>9</sup> The embargo lasted from November 1991 until October 1994 and resulted in two migrations, the first in 1991-92, and the second in 1994.

However, the migrants were denied entry to the United States because of an interdiction policy crafted during the earlier, harsh regime of Jean-Claude "Baby Doc" Duvalier. A surge of boat people fled Haiti between 1979 and 1981, and overwhelmed the abilities of immigration officials to process them or determine their legal status. This led to a September 1981, bilateral interdiction agreement between the United States and Haiti. According to this agreement, the U.S. Coast Guard conducted Immigration and Naturalization Service interviews aboard its cutter. Legal entry to the United States was limited to migrants fleeing political persecution. Haitians determined to be economic migrants were denied admission to the United States and returned to Haiti.<sup>10</sup>

This agreement was still in effect when the first wave of migrants headed for the United States after the military coup of 1991. This migration period lasted through May 1992.

Though the Haitian junta did not plan the flow of migrants, it exploited it fully by making no effort to stop the exodus. The numbers soon overwhelmed the capability of INS agents to interview migrants aboard Coast Guard cutters. To alleviate the pressure placed on Coast

Guard vessels, the U.S. Atlantic Command deployed a military joint task force to establish a migrant camp at the U.S. naval base in Guantanamo Bay, Cuba. It was determined that the camp could house 12,500 migrants and still allow the naval base to continue its normal training and maintenance operations. Army engineers and Navy Seabees established a tent city for migrants on an unused airstrip. Joint Task Force Guantanamo, a force of between 1,000 and 1,500 personnel, provided shelter, food, recreation, education, and medical and dental care for the migrant population and supported the INS interview and returnee operations.

Throughout the next seven months, the population of the camp fluctuated. The camp had 11,000 migrants in December 1991, but only 2,407 at the end of March 1992. However, as the impact of the sanctions spread across wider sections of the Haitian economy, a new surge began in early April 1992, and the camp reached its capacity of 12,500 migrants on May 22, 1992. The Coast Guard provided cutters to increase available shelter on their decks in port for up to 700 migrants until there was room ashore to allow them to disembark.<sup>11</sup> In response, President Bush issued an executive order on May 24, 1992, that suspended the 1981 agreement and instructed the Coast Guard to return all interdicted migrants directly to Haiti.

Although the executive order caused an immediate drop of migrants from 1,500 to 2,000 a week to almost zero, the resulting media coverage of the migrants' plight resulted in an increase of U.S. humanitarian assistance to Haiti. The \$47 million in humanitarian assistance received by Haiti in 1992 indirectly strengthened the junta's

political position by demonstrating that their hard-line stance against the United States produced some benefits for the people and most probably increased financial rewards for the Cedras regime.<sup>12</sup>

#### Cuban Stratagem

In an effort to weaken the Castro government and encourage democracy in Cuba, the United States has enforced economic sanctions in Cuba since October 1960. However, sanctions became more effective with the end of the Cold War. Deprived of its Soviet subsidies, the Cuban economy deteriorated, and hardships for ordinary Cubans increased until conditions reached a critical point. In 1994, U.S. military forces returning to Guantanamo Bay, Cuba, in support of Haitian migrant interdiction operations, faced an additional challenge. The Cuban government was allowing migrant boats to depart for the coast of Florida.

The U.S. Coast Guard, already stretched by the Haitian migration, also intervened to interdict these Cuban boats, and by autumn 1994, the Guantanamo Bay camp housed 20,000 Cubans in addition to 11,000 Haitians. U.S. Southern Command had to establish and man an additional camp for Cubans in Panama to ease the overcrowding. These events placed a heavy demand on military police, engineering, medical, and field services units—capabilities that had been severely reduced by the post-Cold War military drawdown.

Faced with an apparently uncontrollable flood of migrants and severe domestic political pressure, the United States negotiated a settlement with Cuba to halt migration and conducted a military intervention into Haiti to remove Cedras and reinstate Aristide. Nevertheless,

for Castro, the operation was a success as it increased the numbers of migrants housed at Guantanamo Bay U.S. Naval Base to a level that forced the evacuation of military families to the United States and the cessation of routine U.S. Navy and Marine training and maintenance operations. Today, many of these training and maintenance functions remain transferred to naval facilities on the U.S. East Coast.

In addition to the challenges caused by these secondary effects of sanctions, increased use of military, C4I—command, control, communications, computers, and intelligence—and surveillance make sanctions enforcement operations easier. Maximizing the effectiveness of sanctions and embargo operations restricts the ability of the armed forces to prepare for their traditional wartime missions.

#### The Enforcer

Sanctions regimes that impose exclusion zones or embargoes normally require the selective and limited use of force and can be as costly as traditional military operations. Therefore, when designing enforcement activities requiring U.S. military forces, it is necessary to assess both the short-term financial and the longer-term readiness impacts. In the past decade, the United States has been strapped with enforcing sanctions regimes around the world, stretching its reduced resources.

■ **Haiti.** Following the imposition of sanctions against Haiti by the Organization of American States in 1991, the U.S. Navy and the U.S. Coast Guard contributed most of the ships for the maritime interdiction operations that intercepted shipments of embargoed goods by sea, while U.S. Army forces, working with their Dominican Republic counterparts, limited smuggling

across the land border into Haiti.<sup>13</sup> U.S. military forces deployed to support these efforts made maximum use of their specialized C4I and surveillance capabilities to enhance the effectiveness of the interdiction operations. From 1991 until 1994, reported incremental costs for these operations exceeded \$65 million.

■ **Former Yugoslavia.** Since 1992, both U.S. maritime and ground forces have been employed against the former Yugoslavia to enforce economic sanctions against Serbia, as well as the arms embargo applying to all the former Yugoslav republics.<sup>14</sup> These events resulted in incremental costs in excess of \$200 million through 1996. Following the beginning of open resistance to Serbian rule by the Kosovo Liberation Army in 1998, the United States and other Western nations imposed political sanctions backed by the threat of military action in an attempt to force Slobodan Milosevic to end his “ethnic cleansing” of the province. NATO began enforcement on March 11, 1999, and conducted a 12-week air campaign to force Serbian compliance. This effort resulted in serious challenges to post-operational readiness for the U.S. Air Force and the U.S. Army. For example, \$1.4 billion in supplemental funding was needed in fiscal year 1999 to replenish U.S. precision-guided munition stockpiles.<sup>15</sup>

■ **Turkey and Iraq.** Operation Northern Watch/Provide Comfort (ONW) is a political sanction and humanitarian response mission designed to deter the repression of the Kurd minority population in Iraq. ONW was initially supported by air forces operating out of Turkish bases and ground forces located in northern Iraq. In 1995, the U.S. Agency for International Development and

some UNICEF assets replaced U.S. ground forces. Due to the requirement for air patrolling in addition to the ground operations, the incremental costs for the 1991-1995 period exceeded \$850 million.

Another coalition, Operation Southern Watch, employs U.S. and British air forces to discourage the aggressive tendencies of the Iraqi government against the Shia population.<sup>16</sup> The mission is accomplished by air patrolling of defined “no enhancement” and “no fly” zones and by the use of deadly force against Iraqi violators and for self-protection. These operations are supported by land-based aircraft and carrier-based aircraft deployed in the Arabian Gulf. Since 1991, the estimated incremental costs have exceeded \$2.5 billion.

■ **Arabian Gulf Maritime Interdiction Operations.** A third sanctions enforcement activity against Iraq is somewhat more complex. Maritime interdiction operations conducted in the Arabian Gulf by the U.S. Navy and other coalition partners support United Nations Security Council Resolutions (UNSCR) 661 and 665, which severely restrict international commerce with Iraq except for medicine and food. These resolutions are enforced by the U.S.-led multinational interdiction force.<sup>17</sup>

During its first seven months, the interdiction force challenged more than 7,500 merchant vessels, boarded 964 ships, and diverted 51 ships carrying in excess of 2 million tons of cargo in violation of UNSCR. These actions eliminated commerce through Iraqi and Kuwaiti ports and cut off virtually all Iraqi oil revenues.<sup>18</sup> Though the pace of operations has decreased over the last eight years, the maritime interdiction mission is another requirement placed on forces oper-

ating at near-maximum operational and personnel tempo.

#### The Long Haul

Economic sanctions are a long-term operation during which it can be difficult to maintain the original intensity of enforcement. The reduced effectiveness of Maritime Interdiction Operations since the end of the Gulf War in 1991 and their long-term impact on Iraq must be measured against the environment within which they now operate.

Historically, the Gulf nations are merchant cultures, and the conflicts in the Gulf have not changed this fact. Iraq, Iran, and the members of the Gulf Cooperation Council have continued to engage in what they consider legitimate trade—primarily smuggling dates and petroleum products for profit.<sup>19</sup> The Gulf geography aids the smuggler, not the sanctions enforcer. It allows contraband carriers to transit Iranian, rather than international, waters for most of their voyage, so the captains who are caught are not necessarily the sharpest knives in the drawer.

The rewards are also significant. A smuggler will pick up gasoil in Iraq for \$15 a ton; he will then pay the Iranians a toll of \$30 a ton to travel in Iranian waters. If the smuggler reaches the United Arab Emirates with his cargo, he will receive \$200 a ton. Ninety percent of the contraband carriers are flagged in, or effectively controlled, by United Arab Emirate businesses, who consider this good business practice.

There is little duplicity in this logic, for although the Iraqi take from this smuggling is between \$40 million and \$65 million per year, this is insufficient for Saddam to use to threaten either Iran or the Gulf States. However, it allows Saddam to finance his security apparatus and

to maintain himself and his “loyal” followers in the manner to which they have become accustomed.<sup>20</sup>

When the Multinational Interdiction Force does seize a ship, it provides an evidence package consisting of navigation charts, satellite location information, ships logs, videotapes, and oil samples to the UN for validation. Once the seizure has been approved, the interdiction force places a security team, or prize crew, aboard the vessel. This crew mans the vessel in international waters until a Gulf nation agrees to accept the vessel and dispose of it and the cargo in accordance with UN directives.<sup>21</sup> This procedure is taking longer as the sanctions creep on. During January and February 1997, U.S. Naval forces had to support a backlog of 10 prizes awaiting port clearance.

Over the long term, sanctions regimes have prevented the Iraqi army from rebuilding a credible offensive capability, but they have not hurt Saddam, only the Iraqi citizens. This has allowed Saddam to strengthen his position by using the sanctions-induced secondary effects to pressure the international community into an oil-for-humanitarian supplies exchange under the provisions of UNSCR 986.<sup>22</sup> For the United States, the military strategy of “near continuous presence” in the Gulf requires naval, air, and surface resources and a high operational tempo. Today, we are seeing the long-term impact. The U.S. Navy is struggling to mediate the impact of its high operational tempo on its aging air and surface fleet and the personnel who man them. To address these same problems, the U.S. Air Force is reorganizing into an expeditionary air force to efficiently manage the quality of life issues affected by high operational tempo.

## Reality Check

Today, the United States is active in sanctions efforts that protect U.S. interests and people, promote democracy and human rights, encourage free market economies, and restrict proliferation of weapons of mass destruction. These missions will not diminish in the foreseeable future. Whenever any country, alliance, organization, or corporation challenges U.S. interests, policymakers will continue to invoke the threat of economic sanctions.<sup>23</sup>

Sanctions designers must be aware that there are tradeoffs in the choice of policy instruments they employ. Contingency planning, secondary effects and technical support, and sanctions enforcement are unprogrammed activities. Up-front costs are paid out of funds originally designated for operations and maintenance, the key components of military readiness. In fiscal year 1994, incremental costs for sanctions against Cuba and Haiti—Operation Uphold Democracy—contributed to major shortfalls in the Army's operations and maintenance accounts.

Since the supplemental appropriation to cover these shortfalls came after the fact, the readiness ratings of three Army combat divisions were degraded.<sup>24</sup> This impact was again felt as a result of the 1998-1999 Balkans operations. Two army combat divisions reported C4, the lowest readiness rating, and the U.S. Air Force was required to conduct a six-month maintenance stand-down to ensure readiness for future operations.<sup>25</sup>

There are no free lunches. Military funding expended to support sanctions regimes is not available to meet higher priority national security requirements. When committing military resources in pursuit of national interests, maintaining an

acceptable balance between peacetime requirements and military preparedness will remain the principal challenge into the 21st century. ■

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## NOTES

1. According to Undersecretary of State Stuart E. Eizenstat, U.S. sanctions were imposed 61 times between 1993 and 1996—more than half the total since World War II. *Washington Post* (January 8, 1998).

2. Gary Hufbauer, Jeffrey Schott, and Kimberly Elliot, *Economic Sanctions Reconsidered: History and Current Policy*, 2nd ed. (Washington, DC: Institute for International Economics, 1990).

3. William T. Johnsen, *The Future Roles of U.S. Military Power and Their Implications* (Carlisle, PA: Strategic Studies Institute, April 18, 1997), p. 8. Johnsen uses the term *coercive diplomacy* in the context developed by Stanford University professors Gordon Craig and Alexander George.

4. Linda D. Kozaryn, "Shelton, Chiefs to SASC: Optempo, Limited Funds Erode Readiness," *DefenseLINK News* (October 28, 1999) <<http://www.defenselink.mil/news/Oct1999>>.

5. Incremental costs shown for Department of Defense Contingency Operations from fiscal year 1991 to 1996 were derived from information provided by Headquarters, U.S. Air Force.

6. Harry G. Summers, *The New World Strategy* (New York: Touchstone, 1995), p. 170.

7. Frederick S. Calhoun, *Uses of Force and Wilsonian Foreign Policy* (Kent, Ohio: Kent State University Press, 1993), pp. 18-25.

8. John Strelau, *Sharpening International Sanctions* (Washington, DC: Center for Strategic and International Studies, 1996), p. 44.

Strelau is the Jan Smuts Professor of International Relations at the University of Witwatersrand. Prior to his current position, he served as the advisor to the executive

director of the Carnegie Commission on Preventing Deadly Conflict.

9. Earnest H. Preeg, *The Haitian Dilemma* (Washington, DC: Center for Strategic and International Studies, 1996), p. 21.

10. *Ibid.*, p. 58.

11. Bernard F. Griffard, "Final Action Report—Commander, Army Forces, JTF GTMO," a report submitted to the Commander, I Corps, Fort Lewis, WA, June 1992.

12. Preeg, *The Haitian Dilemma*, p. 61.

13. Institute for National Strategic Studies, *Strategic Assessment 1996* (Washington, DC: National Defense University, 1996), chapter 13, p. 8.

14. In 1992, the Federal Republic of Yugoslavia proclaimed itself the successor government to the Socialist Federal Republic of Yugoslavia following the secession of Slovenia, Croatia, Bosnia and Herzegovina, and Macedonia. The United States, however, does not recognize the new government and considers instead that the country consists of two republics—Serbia and Montenegro—and two independent provinces—Kosovo and Vojvodina—which were historically a part of Serbia.

15. William S. Cohen and General Henry H. Shelton, *Joint Statement on the Kosovo After Action Review before the Senate Armed Services Committee* (Washington, DC: Office of the Secretary of Defense, October 14, 1999).

16. Information gathered from interviews with Colonel Gerald B. Thompson, chief, Middle East/Africa, Joint Chiefs of Staff, Directorate of Plans, J5; Colonel William H. Jackson, Lieutenant Colonel Terry Parker, and Lieutenant Colonel Allan D. Childres, Policy and Strategy Division, J5, U.S. Central Command, March 7, 1997.

17. The Multinational Interdiction Force is composed at various times by vessels of the following coalition members: Australia, Belgium, Canada, Italy, Netherlands, New Zealand, United Kingdom, and the United States. The Commander, U.S. Naval Forces, Central Command, oversees the day-to-day operations and interface with the maritime community. The U.S. Department of State coordinates the UN liaison, maritime adviso-

ries, and diplomatic efforts.

18. Department of Defense, Final Report to Congress, *Conduct of the Persian Gulf War* (Washington, DC: U.S. Government Printing Office, April 1992), p. 60.

19. The GCC members are Saudi Arabia, Kuwait, Bahrain, Qatar, the United Arab Emirates, and Oman. It was organized following the fall of the Shah as a counterbalance to Iranian influence in the region. Initially established with an economic focus, it has taken a greater role in regional security issues since 1990.

20. Information gathered from interviews with Rear Admiral A.G. Harms, Jr., Deputy J3, U.S. Central Command, March 7, 1997;

and Commander Scott Jones, Bureau of Political-Military Affairs, U.S. Department of State, February 12, 1997.

21. Gasoil cargo and vessels are sold with proceeds going into a UN account. Nongasoil cargoes—dates for example—are sold and proceeds are placed in a blocked account. This restricted account provides a parking space for funds garnered from nonpetroleum cargo sales. It is not accessible by Iraqi interests until sanctions are withdrawn.

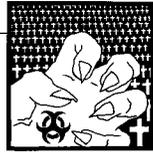
22. United Nations Security Council Resolution 986 (UNSCR 986) allowed Iraqi oil sales of US\$2 billion over six months. Sales receipts are placed in a UN controlled escrow account where payments are made

for the purchase of food, medicine, and humanitarian supplies approved by the UN Sanctions Committee. Additional sales have been authorized since the initial implementation of UNSCR 986 in 1997.

23. William Drozdiak, "A Call for Pursuit of Bosnian War Criminals Resisted" <<http://www.washingtonpost.com>>, June 13, 1997.

24. Togo West Jr. and Dennis J. Reimer, *A Statement on the Posture of the United States Army Fiscal Year 1997* (Washington, DC: Office of the Chief of Staff of the Army, 1997), p. 52.

25. Elaine M. Grossman, "U.S. Forces Still Faced High Readiness Risk after Kosovo Air War," *Inside the Pentagon* (January 6, 2000).



# Scarcity and Conflict

*In the future, violent conflict fueled by scarce resources may spread beyond the borders of impoverished countries.*

BY THOMAS F. HOMER-DIXON

It is easy for the billion-odd people living in rich countries to forget that the well-being of about half the world's population of 6 billion depends on local natural resources. Sixty to 70 percent of the world's poor people live in rural areas, and most depend on agriculture for their main income. A large majority of these people are small-holder farmers, including many who are semisubsistence, which means they survive mainly by eating what they grow. Over 40 percent of people on the planet—some 2.4 billion—use fuelwood, charcoal, straw, or cow dung as their main source of energy; 50 to 60 percent rely on these biomass fuels for at least some of their primary energy needs. Over 1.2 billion people lack access to clean drinking water; many are forced to walk far to get what water they can find.

The cropland, forests, and water supplies that underpin the livelihoods of these billions are renewable. Unlike nonrenewable resources such as oil and iron ore, renewables are replenished over time by natural processes. In most cases, if used prudently, they should sustain an adequate standard of living indefinitely. Unfortunately, in many regions where people rely on renewables, they are being depleted or degraded faster than they are being renewed. From Gaza to the Philippines to Honduras, the evidence is stark: aquifers are being overdrawn and salinized, coastal fisheries are disappearing, and steep uplands have been stripped of their forests, leaving their thin soils to erode into the sea.

This environmental scarcity helps generate chronic and diffuse subnational violence—exactly the kind of violence that bedevils conven-

tional military institutions. Around the world, we see conventional armies pinned down and often utterly impotent in the face of interethnic violence or attacks by ragtag bands of lightly armed guerrillas and insurgents. As yet, environmental scarcity is not a major factor behind most of these conflicts, but we can expect it to become a more important influence in coming decades because of larger populations and higher per capita rates of resource consumption.

## Growth and Consumption

Since 1900, the world's population has increased fourfold. This increase, combined with much higher per capita consumption of materials and energy, has produced huge jumps in global energy consumption, carbon emissions, water use, fish consumption, land degradation, and deforestation. While fertility rates have dropped sharply in recent years in most poor countries, it is premature to declare that the problem of human population growth is behind us. The largest number of girls ever born have yet to reach their reproductive years, which ensures tremendous momentum behind global population growth. Even under the most optimistic projections, the planet's population will expand by almost a third—2 billion people—by 2025.

Real economic product per capita is also currently rising by about 1 percent a year. Combined with global population growth, Earth's total economic product is therefore increasing by about 2.3 percent annually. Today's global product of about \$30 trillion should exceed \$50 trillion in today's dollars by 2025.

A large component of this growth will be achieved through yet higher consumption of the planet's natu-

ral resources. Already, as geographers R. Kates, B.L. Turner, and W. C. Clark write, “Transformed, managed, and utilized ecosystems constitute about half of the ice-free Earth; human-mobilized material and energy flows rival those of nature.”<sup>1</sup> Such changes are certain to increase, because of the ever-greater scale and intensity of human economic activity. We will see a decline in the total area of high-quality cropland, along with the widespread loss of remaining virgin forests. We will also see continued degradation and depletion of rivers, aquifers, and other water resources and the further decline of wild fisheries.

Regional scarcities of these renewables are already affecting large populations in poor countries. But during the last decade, global environmental problems, especially climate change and stratospheric ozone depletion, have generally received more attention in the popular media in the industrialized world. The social impacts of these problems, in particular climate change, may eventually be very large, but these impacts will probably not be decisively clear until well into the next century. Moreover, climate change is most likely to have a major effect on societies not by acting as an isolated environmental pressure, but by interacting with other long-present resource pressures, such as degraded cropland and stressed water supplies.<sup>2</sup> Although global atmospheric problems are important, policymakers, the media, and the public in rich countries should focus more of their attention on regional environmental scarcities of cropland, water, and forests in the developing world.

#### Sources of Scarcity

Environmental scarcities usually have complex causes. The depletion

and degradation of a resource are a function of the physical vulnerability of the resource, the size of the resource-consuming population, and the technologies and practices this population uses in its consumption behavior. The size of the population and its technologies and practices are, in turn, a result of a wide array of other variables, from women’s status to the availability of human and financial capital.

In addition, resource depletion and degradation are together only one of three sources of environmental scarcity. Depletion and degradation produce a decrease in total resource *supply* or, in other words, a decrease in the size of the total resource pie. But population growth and changes in consumption behavior can also cause greater scarcity by boosting the *demand* for a resource. Thus, if a rapidly growing population depends on a fixed amount of cropland, the amount of cropland per person—the size of each person’s slice of the resource pie—falls inexorably. In many countries, resource availability is being squeezed by these supply and demand pressures.

Finally, scarcity is often caused by a severe imbalance in the distribution of wealth. As a result, some groups in a society get disproportionately large slices of the resource pie, while others get slices that are too small to sustain their livelihoods. Such unequal distribution—or what I call structural scarcity—is a key factor in virtually every case of scarcity contributing to conflict. Often the imbalance is deeply rooted in institutions and class and ethnic relations inherited from the colonial period. It is frequently sustained and reinforced by international economic relations that trap developing countries into dependence on a few raw material exports.

It can also be reinforced by heavy external debts that encourage countries to use their most productive environmental resources—such as their best croplands and forests—to generate hard currency rather than to support the most impoverished segments of their populations.

In the past, analysts and policymakers usually addressed these three sources of scarcity independently. But research shows that supply, demand, and structural scarcities interact and reinforce each other in extraordinarily pernicious ways.

■ **Resource capture.** This interaction occurs when powerful groups within a society recognize that a key resource is becoming more scarce and use their power to shift in their favor the laws and institutions governing resource access. This shift imposes severe structural scarcities on weaker groups. Thus, in the Mexican state of Chiapas, land scarcities, partly caused by rapid population growth, encouraged powerful landowners and ranchers to exploit weaknesses in the state’s land laws to seize lands from campesinos and indigenous farmers. Gradually these peasants were forced deeper into the state’s lowland rain forest, farther away from the state’s economic heartland, and deeper into poverty.

In the Jordan River basin, Israel’s critical dependence on groundwater flowing out of the West Bank—a dependence made acute by an increasing Israeli population and salinization of aquifers along the Mediterranean coast—has encouraged Israel to restrict groundwater withdrawals on the West Bank during the occupation. These restrictions have been far more severe for Palestinians than for Israeli settlers. They have contributed to the rapid decline in Palestinian agriculture in the region, to the dependence of Pal-

estinians on day labor within Israel and, ultimately, to rising frustrations in the Palestinian community.

■ **Ecological marginalization.** Another kind of interaction occurs when a structural imbalance in resource distribution joins with rapid population growth to drive resource-poor people into ecologically marginal areas such as upland hillsides, areas at risk of desertification, and tropical rain forests. Higher population densities in these vulnerable areas, along with a lack of the capital and knowledge needed to protect local resources, cause local resource depletion, poverty, and eventually further migration, often to cities.

Ecological marginalization affects hundreds of millions of people around the world, across a wide range of geographies and economic and political systems. For example, in the Philippines, an extreme imbalance in cropland distribution between landowners and peasants has interacted with high population growth rates to force large numbers of the landless poor into interior upland regions of the archipelago. There, the migrants use slash-and-burn agriculture to clear land for crops. As more millions arrive from the lowlands, new land becomes hard to find; and as population densities on the steep slopes increase, erosion, landslides, and flash floods become critical.

#### The Importance of Context

Environmental scarcity is never a sole or sufficient cause of large migrations, poverty, or violence; it always joins with other economic, political, and social factors to produce its effects. In the Filipino case, for example, the lack of clear property rights in upland areas encouraged migration into these regions and discouraged migrants from con-

serving the land once they arrived. And President Marco's corrupt and authoritarian leadership reduced regime legitimacy and closed off options for democratic action by aggrieved groups.

Analysts often overlook the importance of such contextual factors and jump to unwarranted conclusions about causation. Some, for instance, have asserted that rapid population growth, severe land scarcity, and the resulting food shortfalls caused the 1994 Rwandan genocide. In an August 1994 editorial, the *Washington Post* argued that, while the Rwandan civil war was "military, political, and personal in its execution," a key underlying cause was "a merciless struggle for land in a peasant society whose birthrates have put an unsustainable pressure on it."<sup>3</sup> Yet close analysis shows that the genocide arose mainly from a conventional struggle among elites for control of the Rwandan state. Land scarcity played at most a peripheral role by reducing the legitimacy of the regime in the countryside and restricting alternatives for the elite to enrich themselves outside of government.<sup>4</sup>

It's also possible, however, to err in the opposite extreme and claim that scarcity is wholly a result of political, economic, and social factors, such as failed institutions and policies.<sup>5</sup> But our research has identified three reasons why such arguments are incomplete at best.

First, environmental scarcity is not influenced only by social factors like institutions and policies. Scarcity can affect these institutions and policies in harmful and complex ways. For instance, during the 1970s and 1980s, the prospect of chronic food shortages and a serious drought encouraged the governments of Senegal, Mauritania, and Mali to build a series of irrigation

and flood-control dams along the Senegal River. Because of critical land scarcities elsewhere in the region, land values in the basin shot up. To profit from this change, the Mauritanian government, controlled by Moors of Arab origin, captured the resource by rewriting the laws governing land ownership and abrogating the traditional rights of black Mauritians to farm, herd, and fish along the Mauritanian side of the river. Thus, regional land and water scarcity influenced Mauritania's institutions and laws of land ownership in a way that harmed the interests of a substantial fraction of the country's population.

Second, the degree of environmental scarcity a society experiences is not, as it turns out, wholly a result of economic, political, and social factors, such as failed institutions and laws of land ownership; it is also partly a function of the particular physical characteristics of the environment. These characteristics are, in some respects, independent of human activities. For instance, the depth of soils in the Filipino uplands prior to land-clearing and the features that make Israel's aquifers vulnerable to salt intrusion are physical givens of these environmental resources.

Third, once environmental scarcity becomes irreversible—as, for example, when Haiti's vital topsoil washes into the sea—then the scarcity is, almost by definition, an external influence on society. Even if enlightened reform of institutions and policies removes the underlying political and economic causes of the scarcity, because the scarcity itself is irreversible, it will remain a continuing burden on society.

Policymakers will neither adequately understand nor respond to many important cases of civil violence around the world—cases such

as the Filipino insurgency or the chronic instability in Haiti—if they do not take into account the independent causal role of environmental scarcity.

#### Pivotal Countries

Scarcity-induced resource capture by Moors in Mauritania helped ignite violence over access to water and cropland in the Senegal River basin, producing tens of thousands of refugees. In the southern highlands of Peru, expanding populations, land degradation, and drought spurred the rise of the Sendero Luminoso—or Shining Path—guerrillas. In Haiti, forest and soil loss has worsened a persistent economic crisis that generates strife and periodic waves of boat people. And land shortages in Bangladesh, exacerbated by fast population growth, have prompted millions of people to migrate to India—an influx that has, in turn, caused ethnic strife in the northeastern state of Assam.

Such cases show that severe environmental scarcity can constrain local food production, aggravate poverty of marginal groups, spur large migrations, enrich elites that capture resources, deepen divisions among social groups, and undermine states' moral authority and capacity to govern. Marginal groups that are highly dependent on increasingly scarce resources find themselves trapped in a vise between rising scarcity on one side and institutional and policy failures on the other.

These long-term, tectonic stresses can slowly tear apart a poor society's social fabric, causing chronic popular unrest and violence by boosting grievances and changing the balance of power among contending social groups and the state. Statistical analysis of data from over 100 coun-

tries on land degradation, water pollution, and forest loss shows a significant correlation between environmental degradation and civil strife.<sup>6</sup>

Thus, environmental scarcity is mainly an *indirect* cause of violence, and this violence is mainly *internal* to countries. It is not the type of violence that analysts commonly assume will occur when critical resources are scarce—that is, “resource wars” among countries, in which scarcity directly stimulates one country to try to seize the resources of another.

Although this internal violence may not be as conspicuous or dramatic as wars among countries, it may nonetheless have broad implications. Some of the countries worst affected by internal environmental scarcity are pivotal; in other words, their stability and well-being profoundly affect broader regional and world security.<sup>7</sup> These countries include South Africa, Mexico, Pakistan, India, and China.

India and China deserve particular attention because of their size and importance; together they make up nearly 40 percent of the world's population. Although neither currently exhibits widespread violence in which environmental factors play a role, in both cases there are clear reasons to believe that environmentally induced violence may be widespread in the future.

#### India

Since 1947, when India achieved independence, the country has often seemed on the brink of disintegration. But it has endured, despite enormous difficulties, and by many measures the country has made real progress in bettering its citizens' lives. Recent economic liberalization has produced a surge of growth and a booming middle class, often

estimated at 150 million. However, the country's prospects remain uncertain at best.

Although India has reduced its fertility rates significantly, the rate of population growth in 1998 was still high, at about 1.5 percent a year. India's population in 1999 was one billion, and it expands by some 15 million people annually, which means it adds the equivalent of the population of Indonesia—the world's fourth most populous nation—every 14 years. About 700 million of these people live in the countryside, and a third still lack the income to buy enough food to maintain an adequate diet.<sup>8</sup>

Already, water scarcities and cropland fragmentation, erosion, and salinization are widespread. Fuelwood shortages, deforestation, and desertification also affect broad tracts of countryside.

Rural resource scarcities and population growth have combined with an inadequate supply of rural jobs and economic liberalization in cities to widen wealth differentials between countryside and urban areas. Therefore, wave upon wave of people migrate from the country to the city in search of jobs. The growth rate in many Indian cities is nearly twice that of the country's population, which means that cities like Delhi, Mumbai, and Bangalore double in size every 20 years. As a result, their infrastructures are overtaxed. Delhi has among the worst urban air pollution in the world, power and water are regularly unavailable, garbage is left in the streets, and the sewage system can handle only a fraction of the city's wastewater.

As the country's workforce expands by 6.5 million a year, and as resentment among the poor rises against those castes and classes that have benefited most from economic

liberalization, left-wing politicians have been able to exert strong pressure to maintain subsidies of fertilizers, irrigation, and inefficient industries and to retain statutory restrictions on corporate layoffs. Rapid population growth has also led to fierce competition for limited status and job opportunities in government and education.<sup>9</sup> Attempts to hold a certain percentage of such positions for lower castes have caused bitter intercaste conflict. The right-wing Bharatiya Janata party has often capitalized on upper and middle-caste resentment of encroachment on their privileges, mobilizing this resentment against minorities like Muslims.

These pressures are largely beyond the control of India's increasingly corrupt and debilitated political institutions. At the district and state levels, politicians routinely hire local gang leaders or thugs to act as political enforcers. At the national level, kickbacks and bribes have become common in an economic system still constrained by bureaucracy and quotas. The central government in Delhi and many state governments are widely seen as unable to manage India's rapidly changing needs and, as a result, have lost much of their legitimacy.

Although in recent decades the exploding megacities of the developing world have been remarkably quiet, India shows that the record may be changing. The country's widespread urban violence in early 1993, following the demolition of the Babri Masjid mosque, was concentrated in the poorest slums of cities like Ahmadabad and Mumbai. Gang rapes, murders, and acts of arson continued for months after the demolition.

Indian social institutions and democracy are now under extraordinary strain from a rapid yet incom-

plete economic transition, widening gaps between the wealthy and the poor, chronically weak political institutions, and, not least, continued population growth and worsening environmental scarcities. Should these converging pressures cause major internal violence—or, in the worst case, should they cause the country to fragment into contending regions—the economic, migration, and security consequences for the rest of the world would be staggering.

#### China

Population growth and environmental scarcities are also putting extreme pressure on China's population and government. Most experts and commentators on China have been distracted by the phenomenal economic boom in the country's coastal areas. They have tended to project these trends onto the rest of the country and to neglect the dangers posed by demographic and environmental stresses.<sup>10</sup> But, as with India, the costs of misreading the Chinese situation could be very high. The country has over a fifth of the world's population, a huge military with growing capabilities, and unsettled relations with some of its neighbors. The effects of Chinese civil unrest and internal disruption could spread far beyond its borders.

In recent years, China has embarked on an economic and social transition that is almost unimaginably complicated. Countless urgent problems large and small must be addressed immediately as the country develops at breakneck speed. The management demands on the central, provincial, and local Chinese governments are without precedent in human history.

Chinese leaders recognize that unchecked expansion of the

country's already huge population—now around 1.25 billion—will make economic development difficult. Larger populations and higher per capita resource consumption aggravate regional scarcities of water and land. Water shortages in much of northern and western China are now critical and constrain development.<sup>11</sup>

In 1995, the great Yellow River, still referred to as the "sorrow of China" because of its catastrophic floods in years past, was dry at its mouth for over 100 days because of upstream withdrawals. The aquifers under Beijing supply 50 percent of the city's water, but their water levels are falling by a meter a year, causing the ground to sink throughout the region as groundwater is extracted.

The central government has responded by announcing plans to build a giant canal to move 15 billion metric tons of water annually from a tributary of the Yangtze River in the south to northern regions, including Beijing, a distance of almost 1,400 kilometers (868 miles). If built, this canal will be one of the great engineering feats of human history, cutting across hundreds of geological formations, streams, and rivers; the current plan is to construct an 8-kilometer (5-mile) siphon to suck the water under and past the Yellow River.<sup>12</sup>

The industrial city of Taiyuan, the capital of the central province of Shanxi, is a microcosm of the challenges faced by China's resource managers. Situated in a valley surrounded by mountains that are rich with coal, Taiyuan is an important and rapidly growing producer of steel and chemicals. Long ago the city's demand for water for its industries, homes, and agriculture outstripped the supply of the local Fen River, requiring ever-higher ex-

tractions of groundwater from wells. As in Beijing, the water table is dropping rapidly. A large spring in the valley used for irrigation has almost gone dry. To make matters worse, the city and its industries produce hundreds of thousands of tons of heavily polluted waste water each day, much of which is dumped into the Fen untreated or only minimally treated.

Because agricultural land is so scarce in the region, Taiyuan cannot afford to stop irrigating the rice, wheat, and vegetable fields in the valley. But Fen River water is increasingly laden with dangerous chemicals and salts, including cancer-causing benzene. Local water managers acknowledge that the use of Fen water is slowly ruining the valley's soil, poisoning its crops, and lowering agricultural yields. The only solution is to dilute the river water with groundwater, but this resource is already overtaxed. The managers must therefore make a dreadful trade-off between further damaging the valley's soils and food production and maintaining water supplies to the city's industries and homes.

Senior officials in Taiyuan readily admit that the water problems, if not solved, will eventually cap economic growth in the region; already they must sometimes shut down factories in summer because of shortages. But all the potential solutions—more conservation and recycling, or pumping water 150 kilometers (93 miles) from the already depleted Yellow River—demand new technologies and large amounts of capital. The officials say they do not have the know-how or funds to solve their water crisis adequately.

Water scarcity is only one of a host of resource problems in China.<sup>13</sup> At about a tenth of a hectare, or a quarter acre, per capita,

cropland availability is among the lowest in the developing world. Several hundred thousand hectares of farmland are lost every year to erosion, salinization, and urban expansion. Tracts of villas and suburban-style homes are gobbling up rich rice fields around major cities. Near many towns and cities, new Special Economic Zones—industrial parks that offer tax and service advantages to foreign investors—sprawl across good farmland. Each new auto-assembly plant, poultry-processing site, or paint factory takes a further chunk of valuable farmland. When these losses are combined with population growth, the amount of cropland per person is falling steadily by 1.5 percent a year.

Continued population growth and worsening environmental scarcities make China's rapid economic and social transition harder in many ways. First of all, they increase wealth gaps between the cosmopolitan coast, which is linked to the Pacific economy, and the more conservative interior and northern regions where water and fuelwood are desperately scarce and the land often badly damaged. Although economic growth in many interior regions has been fast, it has tended to lag far behind growth in regions closer to the coast. This widening gap has spurred a circular migration of people in search of economic opportunity—a huge flow, often estimated at 100 million people, moving back and forth between rural areas and coastal cities.

One of human history's great migrations, this movement has gone largely unremarked in the West, yet a visitor sees its evidence everywhere. The halls, corridors, and stairwells of major train stations teem with weathered and disheveled peasants from the countryside on their way to the city. In big cities,

construction sites are lined with the tents and shacks of workers from rural areas; in Shanghai alone, over a million newcomers live on construction sites, moving from one to another as work demands. This flood of rural migrants has produced a jump in crime and a visible decline in cleanliness and hygiene in the big cities.

Resource shortages increase wealth gaps not only between regions, but also between rich and poor. Shortages of land and water increase opportunities for powerful members of China's elite—often well-connected members of the Communist Party or their family members—to gain windfall profits through speculation.

In addition, environmental problems and population growth boost the already huge capital demands faced by the state and the economy. New dams and canals have to be built to store scarce water and move it around, cheap housing is needed for rural-urban migrants, and agricultural stations and research laboratories need funding to increase food output.

Finally, resource and environmental stresses increase the susceptibility of the Chinese economy and society to sudden shocks like droughts, floods, and sharp changes in the international economy. A visitor gets the impression that the country has a razor-thin margin for error when it comes to basics such as energy, food, and water. The leadership, media, and general public are acutely aware, for instance, of national food production. A slight shortfall in grain production in 1994 pushed up inflation sharply; and each June, the whole country seems to breath a sigh of relief if a good wheat harvest is announced.

These three problems—rising wealth differentials, capital short-

falls, and susceptibility to shocks—are not unmanageable, but they demand consistently strong, competent, and resilient government at all levels of society.

We all have a stake in the success of the grand Chinese experiment with economic liberalization. In a land of scarce environmental resources and an expanding population, rapid economic growth is essential to provide capital, jobs, and know-how. But this rapid growth itself often worsens the country's underlying resource scarcities and environmental problems, and these problems, in turn, threaten growth. Whether and how China breaks out of this vicious cycle will shape much of human history for decades, if not centuries, to come.

#### Ingenuity and Adaptation

Optimists maintain that human ingenuity can overcome the problem of increasing resource scarcity, and that there are no strict limits on the availability of natural resources. Necessity is the mother of invention, and some countries have managed to supply enough ingenuity in the form of new technologies and new and reformed social institutions—like efficient markets, clear and enforced property rights, and effective government—to alleviate the effects of scarcity.

However, politics—the sometimes nasty struggle for relative advantage and power among narrow groups—is a key factor affecting whether or not societies adapt successfully to environmental scarcity.

In Haiti, for example, shortages of forests and soil have inflamed competition among social groups; this competition, in turn, obstructs technical and institutional reform. In some cases, powerful groups that profit from high fuelwood prices have ripped up the seedlings of re-

forestation projects to keep the supply of fuelwood limited. Similar conflicts have occurred around the world—in the Indian state of Bihar, for example, and in South Africa. Societies like these face a widening “ingenuity gap,” a gap which, if it can't be narrowed, will raise grievances and erode the moral and coercive authority of government. This, in turn, will boost the probability of serious civil turmoil and violence. This violence further undermines the society's ability to supply ingenuity. Countries with a critical ingenuity gap therefore risk becoming trapped in a vicious cycle, in which severe scarcity further undermines their capacity to mitigate or adapt to scarcity.

In coming decades, we can expect an increasing division of the world into those societies that can keep the ingenuity gap closed—thus adapting to environmental scarcity and avoiding turmoil—and those that cannot. If several pivotal countries fall on the wrong side of this divide, humanity's overall prospects will dramatically worsen. Such a world will be neither environmentally sustainable nor politically stable. The rich will be unable to fully isolate themselves from the crises of the poor, and there will be little prospect of building the sense of global community needed to address the array of grave political and ecological problems that humanity faces.

#### Eye on the Future

A large proportion of the world's population is almost completely reliant on local cropland, water, and forest supplies for its daily existence. Skeptics usually underestimate the extent to which much of humankind still depends on the natural environment and therefore underestimate the social stress that environmental scarcity can cause.

Environmental scarcity contributes to diffuse, persistent, subnational violence such as ethnic clashes and insurgencies. It rarely if ever contributes directly to conflict among states, that is, to resource wars. During the 20th century, there were a number of interstate wars over, in part, access to nonrenewables like oil and minerals. But there are few modern examples of interstate war over renewables such as cropland, forests, and fresh water.

There are two explanations for this difference. First, in general, states cannot easily or quickly convert renewable resources into assets that significantly augment their power. Second, the very countries that are most dependent on renewable resources also tend to be poor, which lessens their aggressive capabilities.

In coming decades, worsening environmental scarcity in many regions will further exaggerate the world's already gaping differentials between rich and poor societies and between the powerful and the weak within those societies. The world's wealthy regions should not assume that they will be able to wall themselves off from turmoil in societies that do not adapt well to scarcity. We are living cheek by jowl on this planet now. We are all next-door neighbors.

The situation in some parts of the planet may be grave, but the picture is not deterministic or apocalyptic. The study of environmental causes of violence is relatively young. Further research should focus on democracy's effect on the connections between environmental scarcity and violence. Although recent decades have seen a surge of democratization around the world, the term *democracy* is used too loosely by lay commentators and ex-

perts alike. It commonly encompasses an extraordinarily variegated set of social phenomena and institutions that have complicated and multiple effects on the incidence of social turmoil and violence.

Depending on its form, democracy can help people mobilize to reduce environmental degradation and to change skewed distributions of resources. It can also increase state legitimacy and offer challengers nonviolent opportunities to settle their grievances. These processes reduce the probability that environmental scarcity will cause civil strife. On the other hand, in societies that are already highly segmented, certain kinds of democratic institutions can further aggravate cleavages and weaken the state.

By studying cases that exhibit the precursor conditions that may produce violence, including environmental scarcity, but do not in fact exhibit violence, we can further our understanding of the many contextual factors that can influence the relationship between environmental security and violence.■

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#### NOTES

1. B.L. Turner II et al., eds., *The Earth as Transformed by Human Action* (Cambridge: Cambridge University Press, 1990), p. 13.

2. For example, climate change may interact with long-term soil degradation that produces a loss of rooting depth and increased susceptibility of crops to drought. Together, these changes could cause much greater declines in agricultural yields than either would produce by itself.

3. "From Rwanda to Cairo," *Washington Post* (August 25, 1994), p. A18.

4. Thomas Homer-Dixon and Valerie Percival, "Environmental Scarcity and Violent Conflict: The Case of Rwanda," *Journal of Environment and Development* 5 (3) (1996), pp. 270-91.

5. For an argument that stresses the importance of such factors, see Ronnie Lipschutz, "Environmental Conflict and Environmental Determinism: The Relative Importance of Social and Natural Factors," in *Conflict and the Environment*, Nils Petter Gleditsch, ed. (Dordrecht, The Netherlands: Kluwer, 1997), pp. 35-50; see also Wenche Hauge and Tanja Ellingsen, "Beyond Environmental Scarcity: The Casual Pathways to Conflict," *Journal of Peace Research* 35 (3) (1998), pp. 299-317.

6. Hauge and Ellingsen, "Beyond Environmental Scarcity."

7. For a definition, see Robert Chase, Emily Hill, and Paul Kennedy, "Pivotal States and U.S. Strategy," *Foreign Affairs* 75 (1) (1996), pp. 33-51.

8. Robert Repetto, *The "Second India" Revisited: Population, Poverty, and Environmental Stress over Two Decades* (Washington, DC: World Resources Institute, 1994), p. 5.

9. Jack Goldstone analyzes the effects of population growth on competition for social resources, such as a job and status opportunities. See Jack Goldstone, *Revolution and Rebellion in the Early Modern World* (Berkeley: University of California Press,

1991); and Jack Goldstone, "Saving the Environment (and Political Stability Too): Institutional Responses for Developing Nations," *Environmental Change and Security Project Report*, Issue 2 (Washington, DC: Woodrow Wilson Centre, 1996), pp. 33-34.

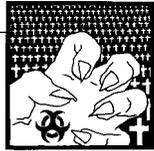
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11. Elizabeth Economy, *Reforms and Resources: The Implications for State Capacity in the People's Republic of China*, Occasional Paper of the Project on Environmental Scarcities, State Capacity and Civil Violence (Cambridge, MA: American Academy of Arts and Sciences and the University of Toronto, 1997).

12. Patrick Tyler, "Huge Water Project Would Supply Beijing by 800-Mile Aqueduct," *New York Times* (July 19, 1994), p. A8, national edition.

13. Vaclav Smil, *China's Environmental Crisis: An Inquiry into the Limits of National Development* (Armonk, NY: M.E. Sharpe, 1993).

14. This article was adapted from his book *Environment, Scarcity, and Violence* (Princeton, NJ: Princeton University Press, 1999). Princeton University Press is the sole owner of the copyright for *Environment, Scarcity, and Violence*.



# Environmental Aftermath in Kosovo

*An inspection of post-conflict Yugoslavia reveals underlying environmental problems that need attention.*

BY ROB DE JONG

**D**uring the 1999 NATO bombing campaign of Yugoslavia, conflicting reports emerged in the media concerning environmental damages from the campaign. Of particular concern were the releases of oils and chemicals from targeted industrial sites, the possibility of hazardous substances entering the Danube River, and the use of weapons containing depleted uranium.

On March 19, 1999, a peace agreement between the federal government of Yugoslavia and the ethnic Albanian minority in Kosovo was negotiated in Rambouillet but not signed by the Yugoslavian government. On March 24, a day after

U.S. Ambassador to the United Nations Richard Holbrooke returned from Yugoslavia, having failed to persuade the government to agree with the Rambouillet accords, NATO started Operation Allied Force and began to bomb targets all over Yugoslavia.

On June 1, after 78 days and after dropping more than 14,000 bombs, NATO suspended Operation Allied Force. The Yugoslavian government agreed to an unconditional withdrawal from Kosovo, and the UN Security Council adopted resolution 1244, which entrusts the establishment of an international civil administration in Kosovo to the UN Secretary General.

The Yugoslavian government claimed that the bombings had

caused severe environmental damage and were intended to inflict damage that would affect human health and natural resources. NATO, on the other hand, claimed that its use of sophisticated, state-of-the-art weapons against carefully selected targets had minimized environmental and other secondary damage.

## Task Force Responds

A UN Interagency Needs Assessment Mission visited Yugoslavia for 12 days in May 1999 to make an initial assessment of the consequences of the conflict even as the bombings and ethnic cleansing continued. Immediately after the UN interagency mission reported its findings, Klaus Töpfer, the executive director of the United Nations Environment Programme (UNEP) and acting executive director of United Nations Centre for Human Settlements (Habitat), created the Balkans Task Force to make a detailed assessment of the impact the conflict had on the environment and human settlements. Pekka Haavisto, Finland's former Minister of Environment and International Development Cooperation agreed to chair the task force. The Balkans Task Force comprises staff from UNEP, Habitat, and independent environmental experts. This provided a rare opportunity for the United Nations to examine the effects of modern warfare on the environment.

In July 1999, after the conflict ended, the task force's core team prepared for a detailed desk study followed by field missions. During the desk study, all available data were compiled and studied, including information from the media, UN and non-UN agencies, NATO, governments including that of the Federal Republic of Yugoslavia, and non-governmental agencies. A comprehen-

sive database was set up to collect and compare all information available regarding the environmental damage caused by the bombings.<sup>1</sup>

#### Dilemmas

The Balkans Task Force chairman, Pekka Haavisto, began the report with the statement that the most endangered resource in times of war is the truth. It was clear from the start that the task force assessment was made in a highly charged political climate; however, the task force aimed to be as objective and scientific as possible. The first priority was to identify potential pitfalls as the task force walked a fine line between conflicting information.

#### ■ Was the information accurate?

The Balkans Task Force team got mixed information from the pre-mission desk study as well as during the field missions. Data released by the media—from radio, television, magazines, press releases, and other magazine sources—about quantities of specific pollutants differed considerably, and experts interviewed by the task force at times had completely different opinions. Some experts, for example, stated that if depleted uranium had been used in the bombs, it would not pose any threat to human health, since such radiation is very low, below natural background radiation levels. Others maintained that bombs containing depleted uranium were widely used in Kosovo, and that many people, especially those living close to bombing sites, were exposed to high levels of radiation from inhaling radioactive particles.

■ **Which sites should the task force visit?** Since the Balkans Task Force could not visit all bombed sites, it had to select a representative sample to draw general conclusions. In addition, since the task force intended

Figure 1. Sites Visited by the Balkans Task Force



to visit the sites widely reported in the media as the most polluted, the core team had already started to collect information on these sites in an extensive database. This database allowed the task force to get a clear idea on conditions at the most relevant sites and allowed the field teams to look for specific pollution expected to be present at certain sites. The task force used information from the database, the findings of the investigative preliminary mission, and information from the Yugoslavian government to determine which sites to visit.

#### ■ How accurate was the bombing?

Official information from NATO press releases, which were aired on television around the world, showed very accurate bombing of targeted areas. NATO claims that their ac-

curacy in bombing resulted in minimal damage to human health, the environment, and cultural and historically important sites and buildings. The Yugoslavian government, however, claimed that many bombs had missed their targets and as a result many innocent civilians died. In addition, they claimed that some targets were purposefully hit to cause environmental pollution with resulting threats to human health. While Yugoslavian sources characterized air bombings of targets in national natural parks as outright targeting of natural heritage sites, NATO stated that only military and strategic sites, especially hilltop telecommunications towers, had been targeted within protected areas.

■ **What damage was due to the conflict?** It was difficult, and in some

cases impossible, to distinguish between environmental pollution caused by the bombings and the pollution existing before the conflict. From an environmental point of view, this distinction is not very relevant. Indeed, if a river is polluted, the cause of the pollution doesn't matter much in view of the need for remediation. More important are the effects and possible remedial measures. Still, the objective of the task force was to determine the effects of the Kosovo conflict on the environment, and therefore the distinction between old and conflict-related pollution was relevant.

■ **Is aid considered humanitarian assistance or reconstruction?** While support for reconstruction, including the rebuilding of houses, offices, and infrastructure such as bridges, roads, and railroads is not allowed under the present embargo, humanitarian aid is allowed. For example, with the cold winter approaching, the European Union recently donated diesel fuel to some Yugoslavian cities for heating purposes. One of the main questions for the task force was whether support for environmental protection could be considered humanitarian aid.

#### Findings

After thorough background information was gathered, the first mission went into Yugoslavia on July 19, seven weeks after the bombings had ended, to visit industrial sites. While international support organizations were entering Kosovo in massive numbers, because of the political climate and the embargo, few such agencies were present in other provinces of Yugoslavia immediately after the conflict. The task force received a great deal of media attention, and all major networks were present when the team entered the first site in Yugoslavia: Pancevo,

a town with a population of more than 100,000 near Belgrade. Pancevo, which boasts a large petrochemical industry including an oil refinery, plastics manufacturing, and a fertilizer plant, was a target of NATO bombing in April.

#### Industrial Sites

Some sites were completely destroyed, such as the oil refinery in Novi Sad, a city of 300,000 on the Danube River. Others were heavily damaged, such as the industries in Pancevo, or experienced relatively little damage, such as the plastics factory in Pristina. No matter the amount of damage involved, it was clear that NATO had been precise in its bombings; for example, one of the targets was the fertilizer factory in Pancevo, which was hit during one of the first days of the NATO campaign.

This fertilizer plant covers a big plot of land. During its first attack, NATO destroyed a small, unmanned pumping station used to heat and subsequently pump diesel around the site. Diesel fuel used to generate electricity was essential to run the factory, and the bomb that destroyed the pumping house brought the whole plant to a standstill.

At other sites the NATO strategy was to destroy the complete installation. For example, in Novi Sad, cluster bombs were used to completely destroy the oil refinery, including the storage tanks. More than two-thirds of the 150 tanks were directly hit or seriously damaged during at least 12 NATO air strikes between April 5 and June 9.

Major human health threats and possible environmental pollution were prevented by swift, and often very risky, action of local staff. For example, after the initial attack at the Pancevo fertilizer plant, some processing units were restarted and

a tank full of highly explosive liquid ammonia was rapidly processed into fertilizer. The factory staff worked day and night to use up the ammonia. A couple of days later the fertilizer plant was attacked again, and a bomb missed the ammonia storage tank by a few meters. Pieces of the bomb damaged the tank, but a large explosion was averted because the factory had managed to empty the tank.

At almost all oil storage facilities the task force visited, such as Prahovo, Pristina and Kraljevo, it was clear that most of the tanks were empty, or almost empty, when hit. Often staff at factories and storage facilities worked around the clock to remove oil and other valuable substances before the installations were bombed. Not only was the oil removed and set aside for military purposes, people also risked their lives to move dangerous substances away from potential NATO targets to protect human health and the environment.

The bombing did, however, cause the release of many hazardous substances, and serious but localized environmental problems were found at the industrial sites in Pancevo. For example, mercury and a chlorine substance, ethylene dichloride, had leaked onto the ground and into the industrial canal, and burning oil and other substances resulted in severe air pollution. At the Zastava car factory in the town of Kragujevac, high levels of PCBs leaked from damaged power transformers. At an oil refinery in Novi Sad, leaking oil resulted in possible groundwater pollution. In the city of Bor, sulfur dioxide emissions from a bombed copper plant created severe air pollution; large amounts of sulfur dioxide were still being emitted in the air when the task force visited the site.

However, the conflict itself was not the only environmental concern. The task force found that many factories had no idea what to do with hazardous wastes before, during, or after the conflict. Many factories had waste stored from before the conflict, and some had no environmental strategies or procedures in place to minimize or process these hazardous wastes.

#### The Blue Danube

One of the principal environmental concerns highlighted by the media and nongovernmental organizations has been possible damage to the Danube River. Since most of the key industrial facilities targeted during the air strikes were located along the river or along its tributaries, there were fears that large quantities of hazardous substances had entered the Danube, affecting not only Yugoslavia but also countries downstream.

The Danube, which flows hundreds of miles through Yugoslavia, Romania, and Bulgaria and empties into the Black Sea, is used for many purposes. It provides drinking water for millions of people, is used for agricultural irrigation, and is a commercial and recreational fishing resource. All these uses could be threatened by contaminants from the bombing.

Based on the water sampling, the field mission concluded that there was no evidence of an ecological catastrophe. As in its mission to industrial sites, the task force found some hot spots, or locally polluted sites, but no full-scale environmental disaster.

Some hot spots are a direct threat to human health and environment—for example, the Pancevo canal, a humanmade canal connected to the Pancevo industrial wastewater treatment plant. The water in this canal was heavily polluted dur-

ing the bombings. The Yugoslavian authorities have temporarily closed off the canal from the Danube, but sooner or later production will start again and the canal will have to be opened. This canal is so polluted it needs to be cleaned completely, a process that includes total remediation of all the sediment on the bottom, a very expensive undertaking.

Until now, Yugoslavia has not participated in international networks for water quality monitoring, pollution reduction, and emergency response. Nor is it part of the International Commission for the Protection of the Danube River or the Convention on Cooperation for the Protection and Sustainable Use of the Danube River, also known as the Danube River Protection Convention. To address environmental concerns that predated the Kosovo crisis, as well as to help in cleanup after the fact, the task force recommends that Yugoslavia be integrated into existing international environmental agreements to protect the Danube.

#### Natural Areas

The Balkan region is exceptionally valuable for the conservation of biological diversity in Europe, and the territory of Yugoslavia is certainly an important component of the overall richness of the Balkan's natural resources.

The Yugoslavian government claimed that "damage inflicted to ecosystems and habitats of endangered species [in Kopaonik National Park] was irreparable."<sup>2</sup> When a Balkans Task Force mission visited the protected areas in Yugoslavia, however, it found significant physical damage from the air strikes within limited areas, but this was relatively minor considering the overall size and function of the pro-

tected areas and ecosystems.<sup>3</sup> However, there is still much unexploded ordnance, an immediate safety issue, which might obstruct recreational use, including tourism, in the long term.

#### Depleted Uranium

One of the greatest concerns, which received a great deal of media attention, was the use of weapons containing depleted uranium. Depleted uranium is a waste product from nuclear reactors. It is extremely dense and is used in the tips of certain ammunition designed to have maximum penetration. It is used in bullets for penetrating armor, but can also be used in cruise missiles. As a waste product, depleted uranium is available in huge quantities and is relatively cheap.

Despite several attempts, the Balkans Task Force could not obtain official data on where or how much depleted uranium was used, either from NATO and its member states or from Yugoslavian authorities.<sup>4</sup> Therefore, this part of the study was carried out through a written assessment only.

The study group consisted of experts from the International Atomic Energy Agency, the World Health Organization, the Swedish Radiation Protection Institute, and the United Nations Environment Programme.

The task force did undertake a small mission to Kosovo, taking basic measurements of radioactivity from random bombing sites. The team's preliminary conclusions are that the risks were restricted to the limited area around a target hit with weaponry containing depleted uranium. People who were in close proximity when a target was hit with depleted uranium weapons may have inhaled dangerous levels of depleted uranium.

## Challenges Ahead

The task force found that the Kosovo conflict has not caused an environmental catastrophe in the Balkan region nor an environmental disaster countrywide in Yugoslavia. However, at some specific local sites, mainly hot spots at industrial sites, high levels of pollutants were found that posed a serious threat to human health and the environment.

The task force also found high background concentrations of pollutants at most sites, as well as in the Danube, an indication that most of the pollution clearly predates the Kosovo conflict. Since these sites lacked environmental strategies to safely store, handle, and treat solid waste during normal operations, much less in a natural disaster or in time of war, improvements in environmental management capabilities are needed. The hot spots identified require immediate attention if further damage to human health and the environment is to be avoided. If no action is taken, the pollution could easily spread and increase the scope of the problem significantly.

From the outset, the task force understood the difficulty of its mission to find reliable information, choose representative sites to visit, determine the accuracy of the bombing, decide the source of environmental damage, and determine the necessity for humanitarian aid. With some degree of certainty, the task force members are confident they obtained an accurate assessment of the environmental damage.

First, there was no reason for Yugoslavia to hide any environmental damage; after all, it was in Yugoslavia's interest to reveal the damage done by the bombings. Second, throughout its assessment, the task force was not denied access to any nonmilitary site. Third, the task force

visited all the sites that the media reported as heavily bombed, such as Pancevo and Novi Sad.

On the other hand, during the task force's travels through Yugoslavia, we noticed many industrial sites that were bombed but which we did not visit. Transformers and chemicals could have leaked at any industrial site bombed. For example, the industrial city of Nis, the second largest city in Yugoslavia, was so severely bombed that citizens reported taking shelter in cellars for most of the nights during the conflict, sometimes tens of nights in a row.<sup>5</sup> When driving through the city, the task force observed, but did not visit, the sites of several destroyed chemical industries. What possible environmental problems might be found at those and other sites not visited by the task force? There were also reports that the water of the river Nis, which flows through the city, was heavily polluted during the conflict by industrial releases.<sup>6</sup> For a more complete picture of the damages, more sites, especially industrial sites, should be visited.

The task force was denied access to any military sites. Since those seemed most heavily bombed, there may be unreported environmental damage at those sites.<sup>7</sup> But in general, the core team is confident that it visited the most polluted sites and that its conclusions are fairly representative of the overall picture of the environmental damage from the conflict.

As for the accuracy of NATO bombings, the task force findings confirm the television images: the bombings were frighteningly accurate. However, we did see some evidence of missed targets and unexploded ordnance.

The task force also found significant levels of background pollution in most places they visited—for ex-

ample in the Danube water, in the sediment of the Danube, in the soil at industrial sites, and in the groundwater. Sophisticated analyses allowed the laboratories to determine the fingerprints of the pollutants; old oil leaks show up differently in laboratory reports than new oil spills. For example, in the vicinity of one of the bombing sites, the task force found PCBs that were different from those released at the bombed site, proving that the PCBs found in the vicinity were spilled before the conflict.

In addition, some pollution was caused indirectly by the conflict. For example, at a huge copper mine in Bor, power transformers were bombed and destroyed during the conflict. Because of the lack of electricity, the filter that separates sulfur dioxide from waste gases has been switched off and the copper mine now emits huge amounts of sulphur dioxide into the air. Task force team members visiting Bor developed sore throats and stinging eyes soon after arriving at the site. Since Bor is situated close to the Bulgarian border, part of this air pollution is going into Bulgaria.

Some major bridges over the Danube have also been bombed, including a very important bridge at Novi Sad, a major transportation crossroads. The bridge is broken in two with the halves hanging into the water on either side of the Danube. Under the terms of the embargo, which forbids support for infrastructure reconstruction, money to repair the bridge is not allowed. As winter sets in, the surface of the Danube will freeze. Since the Danube has a strong current, ice will be carried downstream, and some predict the ice will get stuck at the bridges, blocking the flow of water and causing major flooding in the city. Is help to remove the

bridges and prevent such floods humanitarian aid?

#### Cleaner Future

The United Nations Environment Programme is now trying to find financial backing for remediation efforts at the worst polluted sites and is trying to convince donors that pollution in Yugoslavia and Kosovo needs to be addressed urgently, especially in Pancevo, Novi Sad, Bor, and Kragujevac. The international community, it now seems, is willing to regard this type of support as humanitarian assistance.

Since UNEP is a policy agency that is more catalyst than actor, it does not execute field projects. However, UNEP and the United Nations Development Programme, have joined forces and submitted a joint proposal to solicit donor funding for cleaning up the worst hit sites.<sup>8</sup> This proposal asks for US\$ 17 million to clean up the worst polluted sites, the hot spots identified by the Balkans Task Force.

NATO's military strategy relied on weakening the enemy through destroying carefully selected targets rather than inflicting mass human casualties. As not only military but also other targets were bombed, this resulted in serious environmental and human health problems at selected, mainly industrial, sites. But the task force also found that many of Yugoslavia's environmental problems precede the conflict. The in-

ternational community needs to help the Federal Republic of Yugoslavia join international environmental efforts that will benefit the whole Balkan region as well as to address the site-specific damages that occurred in Yugoslavia during the conflict.■

*Rob de Jong is special assistant to the UNEP director of the Division of Policy Development and Law, based at UNEP headquarters in Nairobi, Kenya. He was part of the Balkans Task Force team and participated in the industrial mission and drafting of the report.*

#### NOTES

1. The task force also conducted an assessment of human settlements in Kosovo. That report is available at the Balkans Task Force website <[www.unep.org](http://www.unep.org)>. Under the embargo regime, support to Yugoslavia for reconstruction is not allowed. An assessment of human settlements damage would result in recommendations for reconstruction. Therefore, for now, the human settlements assessment in Yugoslavia has been put on hold.

2. According to the Yugoslavian Ministry of Environmental Protection, BBC news, (April 17).

3. Natural areas in Kosovo were not visited because KFOR, the NATO force in Kosovo, warned against the presence of uncleared minefields and unexploded ordnance.

4. Although there are strong indications

that depleted uranium ammunition was used—for example, from a U.S. Department of Defense media briefing on May 3, 1999—it is assumed that NATO does not want to share any information on the use of depleted uranium because of the ongoing court cases on the claimed health effects of the use of depleted uranium in the Gulf War.

5. The Balkans Task Force was told that the biggest problem in Nis at present is the mental state of the people, after so many nights of continuous bombings. Reportedly, all sorts of mental illnesses are emerging and the number of suicides has increased sharply.

6. Some sources say that this is because the industries used the bombings to get rid of their stored wastes. Others say it was caused by leaking factories destroyed by the bombings. The Balkans Task Force did not find any evidence for the first statement.

7. During the assessment, we drove past a few military sites, and as observed from the road, those were completely destroyed. We also saw a field full of parked tanks, trucks, and artillery. Obviously, the Yugoslavian military has been successful in hiding some of its equipment from NATO bombs.

8. UNEP, according to its mandate, is not involved in field activities and projects. UNEP is a policy-oriented organization focusing on environmental assessment and support to and promotion of the building of environmental policies at all levels. UNEP also does not have the capacity to execute field projects worldwide. Within the UN system, the United Nations Development Programme is the agency with country offices worldwide, supporting UN field projects. UNEP also has a country office in Belgrade.

# Ethical Dilemmas

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# The Genie in the Petri Dish

**B** iotechnological advances are rapidly changing how we think about human life. But the race for new genetic information opens a Pandora's box of social, political, and ethical quandaries.

Who has the right to such information? How can we balance the individual's right to privacy against the free flow of information necessary for further scientific breakthroughs? U.S. Senator Bill Frist has proposed a National Bioethics Advisory Commission to oversee how this information is managed and to minimize discrimination by health insurers.

In the meantime, several advisory committees have been formed to determine the status of human embryos. James L. Nelson at the University of Tennessee finds that most of these panels sidestep the central question: what is the moral status of the fetus? Nelson says the voice of those with moral concerns must be heard in the course of such deliberations.

Stem cells derived from embryonic material promise to revolutionize medical research in diagnostics and therapies. At the earliest stages of specialization, these cells have the ability to divide without limit and develop

into blood cells and even organs that could be used for transplantation. Kristina Borrer and colleagues with the National Institutes of Health say the NIH will not support federal funding for such research until the complex ethical issues have been resolved. In the meantime, researchers are rapidly discovering the potential of stem cells obtained from adults. In the future, use of fetal tissue may become a moot point.

For couples faced with fertility problems, the ethical debate can become intensely personal. It is now possible for fetuses created in a petri dish to be tested for genetic disorders prior to implantation. Laura Purdy at the University of Toronto's Joint Center for Bioethics says couples could benefit from intensive counseling and a realistic assessment of their chances for success.

Another promising track for research involves the use of blood cells obtained from human umbilical cords, which in the past were most often discarded. Now, say Jamieson Bourque and Jeremy Sugarman at Duke University, we have to decide whether such biological materials are treated as medical waste, a gift, or property that can be bought and sold. Moreover, along with the promise of therapeutic uses comes the possibility for abuse of genetic informa-

tion about the child or its mother.

Private companies, however, aren't waiting to make ethical calls. They are seeking patents, not just on the procedures they invent, but on the very genes they have discovered. Nicholas Hildyard and Sarah Sexton with the Corner House in the United Kingdom propose that the European Union establish a framework to exclude certain processes and products from being patented, including living material such as genes.

Private biotech companies, especially in the United States, however, have already staked claims on huge portions of the human genome, say Canadian law professors Timothy A. Caulfield and E. Richard Gold. To balance the need for economic incentives for research and for the free flow of information, we need to create subtle ways to alter, not abolish, patent law to benefit researchers, industry, and patients.

The Human Genome Project began in a spirit of international cooperation. Today, it has turned into a dash for the gold in uncharted territory where ethics, morality, and the rule of law trail far behind the front runners in the biotechnology race.

*The Editors*



# Open Sesame

*Congress must establish boundaries to protect privacy and promote ethical uses of new genetic information.*

BY BILL FRIST

**A**t the turn of the millennium, we are witnessing the dawn of a new age in science and technology. Advances and discoveries are escalating at a rate that is unprecedented in our tenure on Earth. Since 1969, when Neil Armstrong took his “giant leap for mankind,” routine travel to outer space—a feat once confined to science fiction—is rapidly becoming a reality. Meanwhile, intercontinental travel makes it possible for a person to have breakfast in New York City, hop on a Concorde jet, and eat lunch in Paris. Today, we communicate via email, cellular phones, and teleconferences rather than through letters carried by the postal service.

The advances in space travel and telecommunications have been paral-

leled by gains in biotechnology and medicine. Our understanding of human disease has evolved from gross anatomical pathology to a grasp of the cellular and even molecular basis of disease. Each medical breakthrough offers the promise of new treatments and cures for ailments that affect many Americans and our neighbors in other countries.

Yet new developments in biotechnology or medicine raise difficult legal, ethical, and societal issues that demand resolution. Indeed, public

policy must keep pace with and, where possible, anticipate advances in biotechnology.

In addition, policy decisions must reflect not just the United States and other industrialized nations. All people have a stake in the allocation of the latest biotechnological advances and the planet's limited resources. Therefore, all parties should be present at the discussion table, and scientists and politicians alone should not make the final decision regarding the use of cutting-edge science that promises

to alleviate pain and suffering around the world.

Human Genome

**N**owhere are the ethical, legal, and societal dilemmas more acute than in the field of human genetics. Throughout history, man has attempted to understand the factors that determine the physical and behavioral differences among humans.

Hope for the benefits of genetic research began with the cracking of the genetic code in 1953, when James Watson and Francis Crick described the double-helical structure of DNA. Our understanding of genetic influences has exploded with each new gene identified as a result of the Human Genome Project. The project, launched in 1990 and funded by the Department of Energy and the National Institutes of Health, is devoted to locating and deciphering the roles of each of the approximately 100,000 genes in human DNA.

At the start, researchers thought it would take 15 years to produce a complete transcript of the human genome. Advances and improvements in technology have shaved at least two years off the project's anticipated duration. New genes are being identified and located at ever increasing rates.

At fruition, the Human Genome Project will create a virtual encyclopedia of the human animal. While the volumes, or chromosome, and chapters, or genes, of this encyclopedia will be identified and catalogued possibly as soon as 2003, it will likely take a century or more to identify all the specific functions that are encoded by these genes. Though the human genome encyclopedia will not be complete for many years, genetic testing will allow tantalizing tidbits of information to be used to characterize the genotype, or genetic makeup, of individuals. Such testing will yield powerful information about ourselves; but the use of this information raises critical ethical, legal, and social concerns.

#### Genetic Testing

In the not too distant future, patients and their families may greatly benefit from recent advances in genetic research. Genetic testing—which can confirm the presence or absence of certain disease genes—will become commonplace in medical practice. Currently, predisposition to many diseases, including breast cancer, Alzheimer's disease, Huntington's chorea, and Parkinson's disease, can be learned through genetic testing. As more disease genes become identified, genetic testing or screening for these genes may become standard in medical care to understand who is at risk for certain diseases and to allow patients to take pre-

ventive measures to decrease their risk for particular diseases.

Increased use of genetic testing, however, raises questions regarding the use of the information produced through such testing. For instance, the results of genetic testing could be used to discriminate against individuals who carry genes that increase their risk for developing cer-

that documentation of people's genotypes will create a genetic underclass and that people with "bad genes" may be discriminated against by health insurance providers and prospective employers.

Specifically, health insurers may refuse to cover persons with genetic profiles that indicate risk for future disease, or if forced to provide

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## Mandatory genetic testing raises fears that people

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### with "bad genes" may be discriminated against by

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### health insurance providers and employers.

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tain diseases. Should individuals have the right to keep genetic information private and not reveal it to insurers, employers, or others? And should individuals retain the prerogative to choose not to know the possible consequences of their genetic heritage?

It is my belief that genetic testing should never be mandated for insurance coverage, employment, or other purposes but should be performed only after informed consent is obtained from the individual. Furthermore, informed consent should include a discussion of the subsequent use of the genetic information and the ramifications for the individual and his or her family of the presence or absence of disease-related genes.

#### Genetic Discrimination

With the unraveling of the human genetic tapestry, more and more medical conditions and diseases will be traced to the threads of our DNA. The prospect of widespread or mandatory genetic testing raises fears

health coverage, insurers may charge exorbitantly high premiums. Historically, insurers have been allowed to "cherry pick" patients based on past medical and family history. As a result, some people cannot find affordable coverage or may even be denied coverage altogether.

Some would argue that use of information regarding genetic diseases or predisposition to these diseases is essentially no different from information on pre-existing medical conditions, family history, or high-risk behaviors, such as cigarette smoking, that are associated with increased incidence of disease. Therefore, the argument continues, insurance companies are justified in denying coverage or charging higher fees to individuals genetically predisposed to costly medical problems. Moreover, to mandate equal premium payments for all regardless of genetic profile would introduce reverse discrimination against individuals without disease genes by forcing them to subsidize medical care for those with genetic ailments.

Proponents of disclosure of ge-

netic information further contend that insurance companies are for-profit businesses and, if publicly traded, have the fiduciary obligation to maximize profit for the benefit of their shareholders. This objective is best achieved by weeding out individuals known to carry genetic risk.

This argument is flawed in several respects. Since we all probably

work. Regular screening of individuals at risk of contracting certain diseases will foster early diagnosis and treatment. These preventative steps will prove economically beneficial by reducing long-term health care costs. For these reasons, people must be able to seek genetic information without fear of discrimination in acquiring health insurance.

Likewise, employers should not

the proposal failed in the House, which ended Senate action, and we did not see another comprehensive proposal pertaining to medical privacy until 1995.

The issue of medical records privacy resurfaced as a critical issue in the 104th, 105th, and 106th Congresses. A driving force behind the current debate and push for Congressional action results from the passage of the Health Insurance Portability and Accountability Act of 1996. This act required Secretary of Health and Human Services, Donna Shalala, to adopt standards by February 1998 for transactions involving electronic health-care data. The concern was that, as more health-related information moved electronically, the confidentiality and security of this information might become increasingly jeopardized.

The act further stipulates that if Congress did not enact privacy legislation by August 1999, the secretary shall promulgate regulations setting privacy standards to protect information, but these regulations apply only to electronically transmitted information. To date, Congress has not passed privacy legislation. Therefore, on November 3, 1999, the Secretary published proposed regulations to govern the privacy of medical records.

The passage of a sweeping federal law pertaining to health-related information will be an enormous undertaking. The legislation affects a vast array of constituencies who all share and use health information—among them, patients, providers, insurers, employers, public health officials, researchers, and law enforcement officers. Almost all interested parties have expressed a desire to see Congress enact federal legislation to protect medical information rather than defer to the pro-

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## **Genetic technology should be used for the benefit of workers, not to deny them a job because they may be at risk for a costly illness.**

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have a genetic predisposition for some diseases, a healthy person with the potential to develop a genetic disease should not be the victim of discriminatory insurance practices. Such discrimination is unjust, in part, because a person with a genetic risk may never manifest the disease.

As more of the human genome is delineated, additional medical problems and predispositions will be correlated with specific genetic information. Eventually, few will escape this genetic reaper. Indeed, the vast majority of us will be found to have genes associated with increased risk of disease. As more and more people become aware that they carry genes predisposing them to disease, discriminatory practices will become increasingly intolerable and impractical.

Of course, this does not mean people should refuse genetic testing. Early identification of individuals with genes for specific diseases is imperative for effective preventative health care. When they know their genetic risk, people may make changes in their lifestyles or the environments in which they live and

be allowed to discriminate against individuals as a result of their genetic heritage. Genetic technology should be used for the benefit of workers—for example, to identify people who are more susceptible to workplace hazards—and not to deny them a job because they may be at risk for a costly illness.

### **Confidentiality**

**T**he right to privacy has been central to the beliefs of the American people since this country's founding. Current technologies—including information technologies and advancements in diagnostic biotechnology—have the potential to threaten such rights.

A comprehensive federal law regarding the confidentiality of medical information does not exist; instead, the protection of health information is mired in a complex morass of state laws, federal regulations, and court cases. In the late 1970s, Congress considered a bill ensuring the privacy of medical information. While there was initial bipartisan support for this measure,

posed federal regulations.

Several broad-based bills addressing privacy of medical records have been introduced. These bills focus on 1) individual rights to inspect, copy, and amend one's own medical record; 2) establishment of safeguards to protect medical information; 3) restrictions on the uses and disclosures of health information; 4) civil and criminal sanctions for wrongful disclosure; and 5) the relationship between the proposed bills and existing state laws. Currently, Congress is discussing and merging the best concepts from each of these bills into a comprehensive bipartisan proposal.

The fundamental dilemma that has persisted throughout this debate is how to determine the appropriate balance between competing interests—individual patients who seek protection of privacy rights on the one hand, and societal interests that touch a large number of people on the other. These include improving the overall quality of health care, protecting public health, conducting medical research, and fighting fraud and abuse. An individual's right to privacy regarding his or her medical history is not absolute.

Clearly, medical information must be made available for legitimate societal purposes such as public health and research. Congress' task is to draft legislation that adequately safeguards the confidentiality of a patient's medical information while permitting the flow of this information in a limited number of circumstances.

However, the ability to predict disease raises concerns that our genetic information may be used against us. And this fear of discrimination may keep people from participating in much-needed research protocols. In genetic testing studies at the National Institutes of

Health, for instance, nearly 32 percent of women who were offered a test to determine breast cancer risk declined, citing concerns about health insurance discrimination. Without this necessary research, scientists will be unsuccessful in finding better ways to treat patients.

Ideally, patients should be able to share personal genetic information with their health care providers in

can be developed and tailored to a particular genetic makeup to correct the defective element of the disease-causing gene. Genetically tailored drugs should not only mend defective genes but also eliminate or minimize toxic or adverse side effects.

Many genetic interventions may prove costly, however, and given the current and projected cost of drugs, many people will be unable to af-

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## **Specific drugs can be developed and tailored to a particular genetic makeup to correct the defective element of the disease-causing gene.**

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order to benefit from new genetic technologies, but many may not because they fear what might result if this information should fall into the wrong hands. To ensure the public peace of mind, Congress has the opportunity to support needed research and enact strong provisions to protect the confidentiality of medical information.

### **Designer Genes**

**I**t is likely that genomics, the study of genes and their functions, and pharmacogenomics, the application of genomics to disease, will revolutionize the practice of medicine in this millennium. With the decoding of the human genome, scientists may be able to predict a person's susceptibility to specific diseases. For ailments involving single-gene mutations, such prediction will likely be highly sensitive and specific.

After a person's genetic profile has been determined, a program can be designed to prevent or reduce that person's risk of disease. Using pharmacogenomics, specific drugs

ford pharmacogenomics. As with genetic testing, all individuals should be able to take advantage of pharmacogenomics.

The hope that genetic engineering can correct defective genes and cure some genetic diseases is a more likely scenario in the case of single-gene diseases such as cystic fibrosis or sickle cell anemia. The accuracy of prediction for diseases that involve multiple genes or result from genetic and environmental interactions, however, may be extremely low. These diseases will more likely be treated with a behavioral, environmental, or pharmacogenomic approach.

While genetic technology used to treat an individual facing a debilitating or fatal condition is desirable, other applications of the new genetic science raise serious ethical concerns. For example, genetic engineering or manipulation can also be used to improve on nature and create the "perfect" genetic specimen. And recent advances in genetics may offer tools for sculpting a more genetically "correct" indi-

vidual. This concept is particularly troubling.

In the future, a couple may be able to select from a catalogue of genes specific desirable traits they desire in their offspring. For example, they might want to manipulate genes for hair color, athletic ability, intelligence, or sex. Thus, parents could not only prohibit a genetic illness in their children, they

could portend disastrous unintended consequences.

Consider, for example, sickle cell anemia. Children of parents who both carry the sickle cell mutation have a one in four chance of developing the disease, which is painful, and usually fatal. To ease unnecessary suffering, it would seem advantageous to eliminate the sickle cell gene from our genetic encyclopedia.

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## **The lack of an ethical or moral context in which to ground genetic engineering decisions could lead to frightening abuses.**

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might also choose specific physical and mental traits. As we decipher the secrets encrypted in the double helix, we may find that special talents or gifts—including artistic and athletic capabilities—are a product of one's DNA. The lack of an ethical or moral context in which to ground these decisions could lead to frightening abuses.

Since genes are invariably linked with other genes on chromosomes, such manipulation might also lead to the loss of genetic diversity. This could have unforeseen consequences that would surface only in future generations when we have better deciphered the functions and actions of the complete human genetic template. Ultimately, genes may be lost forever from mankind's diverse gene pool either by genetic selection or substitution. Although many people might applaud deletion of specific disease genes from the human genetic repertoire, eradicating certain segments of our genetic code

But people who simply carry the trait are not affected by the disease and in addition are afforded a limited protective advantage against malaria. As a consequence, completely eliminating the sickle cell mutation may result in an increased incidence of malaria in areas of the world where malaria is indigenous.

Until we fully understand all the actions and interactions of the 100,000 genes constituting the human genome, eliminating certain genetic mutations seems imprudent at the least and may prove disastrous to the survival of our species.

### **Ethical Foundation**

**T**o see that these scientific advancements are put in an appropriate ethical context, I have proposed the establishment of an independent, permanent National Bioethics Commission. It would be representative of the public at large, with combined participation of

experts in law, science, theology, medicine, social science, and philosophy/ethics along with interested members of the public. This commission would report to Congress annually on the state of science and promote thoughtful consideration regarding appropriate and acceptable changes in policy.

With the advent of genomics and pharmacogenomics, Forrest Gump's assertion that "life is like a box of chocolates because you never know what you are going to get" may no longer ring true. If DNA programs both physical and behavioral constitution, by mapping one's genes we may be able to know what we are going to get. On the other hand, through the use of genetic engineering, we may unwittingly eliminate or reduce the diversity that's vital to the survival of our species. In short, we do not want to eliminate all the caramels and end up with a box of nothing but chocolate-covered cherries.

Genomics and pharmacogenomics promise new therapies and approaches for many diseases and conditions afflicting humankind, and these therapies must be shared globally. We must offer our knowledge and technology to our international neighbors whose level of biomedical research may lag behind our own. We must also do our utmost to ensure that genetic technologies are used to prevent and ease suffering rather than to enhance our species. Ultimately, our aim is to improve the human condition, not reinvent the human form.■

*U.S. Senator Bill Frist, a Republican from Tennessee, is a heart-lung transplant surgeon.*



# Ethics and Embryos

*Consensus on the use of human embryonic stem cells may be impossible, but all voices need to be heard in the deliberations.*

BY JAMES LINDEMANN NELSON

**O**n November 5, 1998, scientists at Johns Hopkins and the University of Wisconsin announced they had succeeded in establishing culture lines from human embryonic stem cells. This announcement added new urgency to a long-standing controversy: can the hope of scientific progress and potential medical advances justify the destruction of human embryos?

The stem cells, which researchers isolated at the biopharmaceutical company Geron Corporation, are intriguing entities. They are, in principle, capable of producing any form of human tissue—this is the biological property known as pluripotency. Thus, they are even more therapeutically promising than stem cells derived from other sources such as adult bone marrow or umbilical cord blood. Better un-

derstanding the nature of these special cells may well lead to effective therapies for such scourges as Alzheimer's disease, Parkinson's disease, cancer, diabetes, heart disease, and other illnesses.

Human embryonic stem cells are also intriguing entities ethically, however, and herein lies the rub. In order to obtain these stem cells, blastocytes—human embryos in very early stages of development—have to be destroyed. The outer cellular layer, which is the precursor to the placenta, is dissolved, allowing access to the inner cell mass of the blastocyte. In other circumstances, those inner cells might develop into the fetal body. (See "A Stem Cell Primer" in this issue of FORUM.)

Treating blastocysts in this fashion can be enormously distressing to some citizens who may have to help foot the bill if federal funding

becomes available for such research. Yet the hope of immense medical benefits from human embryonic stem cell research is enormously attractive to others.

Shortly after Geron's announcement, a number of authoritative groups, hoping to guide both publicly and privately funded research on human embryonic stem cells, issued reports on the ethical problems involved. These bodies include the Ethics Advisory Board constituted by Geron Corporation; the American Association for the Advancement of Science (AAAS) in concert with the Institute for Civil Society<sup>1</sup>; the Center for Bioethics and Human Dignity<sup>2</sup>; and, most recently, the National Bioethics Advisory Commission, which was established by executive order of the president in 1995 to provide recommendations concerning governmental policies or activities as they involve ethical issues emerging from biological research and its clinical applications.<sup>3</sup>

Of these four bodies, only the Center for Bioethics and Human Dignity, a Christian educational foundation, has been implacable in its opposition to all research involving the destruction of embryos, no matter how it is funded. The other committees have given a more or less cautious green light to stem cell research. They warn, however, that the forms and limits of federal support must be clarified. Other recommendations range from ensuring appropriate forms of review and approval of ongoing work to idealistic calls for private corporations involved in human embryonic stem cell work to respect global justice by ensuring that emerging therapeutic benefits are widely available, even in impoverished regions.

While these issues are of considerable importance, the central moral

issue remains the status of human embryos. In short, can destroying embryos to obtain human embryonic stem cells be ethically justified under any circumstances? If so, does it matter ethically whether the cells are derived from left-over embryos originally derived from assisted reproduction technologies such as *in vitro* fertilization, from tissue gathered from aborted fetuses (see “Empowerment or Danger” in this issue of FORUM), or from embryos created for the sole purpose of conducting research?

A second issue, the ethics of funding such research, enters the realm of political policy. If public funding of research involving human embryonic stem cells is deemed appropriate, should such federally supported research restrict itself to cell lines derived from private sector research, or should public funding be used in the derivation as well as the research uses of these cells?

Controversies over funding reflect the contentious character of the central question: what are embryos in the moral sense?

#### Ethics in the Open

In a recent essay, the legal theorist and bioethicist Alta Charo reinvigorated the discussion over what comprises appropriate goals and procedures governing public deliberation about ethical issues.<sup>4</sup> Charo, who has served on a number of public ethics committees, revisited the concept of ethics in the public square—that is, the civic involvement of citizens who might expect to have a voice in what their government endorses and supports fiscally.

Charo’s work challenges the idea that public ethics advisory bodies should address the issue of what embryos are, from a moral perspective. She argues that such groups can effectively sidestep these vexing

issues and still produce recommendations that will be effective in forming ethically defensible research policies.

As Charo notes, the concept of public ethics faces challenges and limitations that do not trouble private efforts to form our consciences on such matters. While groups representing particular religious organizations may in principle use any argument their traditions offer, the repertoire of arguments open to them seems considerably restricted if they hope to influence public policy. Secular, and in particular governmentally instituted bodies, are even more restricted. In a pluralistic community, where the state professes its incompetence to determine issues of religious doctrine or to adjudicate philosophical conflicts, how can particular positions on matters of deep moral controversy be defended?

Yet although the promise of liberation from intransigent, seemingly interminable ethical tangles might be attractive, it is too good to be true. If we want to find out more about some of the most scientifically and medically fascinating things about embryos, we are going to have to continue to explore what is most morally fascinating about them as well—and do it in public.

#### Destroying Embryos?

Although scientific understanding of the biology of human embryos is becoming ever more profound, there is little real consensus about what embryos are from the perspective of morality. Some think of embryos as very tiny children who possess a right not to be killed that is as robust as the right of any other human being. Other no less thoughtful people regard embryos as morally on a par with other re-

newable human tissues such as blood and hair, and therefore see them as a means to whatever ends we might choose. Between these extremes are those who claim for the embryo a right to respect, but differ about why such entities deserve our respect, and even about what a right to respect means as a practical matter.

This controversy mirrors, of course, the furor over abortion; and governmental response to embryo research controversies is strikingly similar to governmental abortion policies. Just as the federal government in principle protects women’s right of access to abortion, so too it has passed no law forbidding research on embryos and fetuses. Just as the public purse does not fund abortions, it also withholds funding for research that threatens the viability of human embryos. A rider to that effect on the appropriations bill for the Department of Health and Human Services, which funds the National Institutes of Health, has been persistently renewed.

The AAAS and the National Bioethics Advisory Commission want to shift the terms of this compromise, at least as it relates to research funding. AAAS advocates that public funds be made available for research that *uses* human embryonic stem cells, but it does not support using such money to support the actual *derivation* of the cells, which requires the destruction of human embryos. AAAS believes that such a socially contentious task is better left in the hands of privately funded scientists.

The National Bioethics Advisory Commission goes even further. Since important scientific information may emerge solely through studying how such tissue might best be collected from the embryonic source, the Commission recom-

mends that the law be amended to allow funding for research protocols involving derivation as well as use of embryonic tissue. The Commission draws its line at the *creation* of embryos for the express purpose of research, which it does not regard as appropriate for public funding. While the Commission advocates federal funding for protocols that involve the destruction of already existing embryos left over from assisted reproduction therapies, it does not countenance public support for any protocol that merges human gametes for the express purpose of creating "research" embryos.

This position disturbs ethicists at the Center for Bioethics and Human Dignity. In their statement on the matter, "On Human Embryos and Stem Cell Research," the Center maintains that any such shift in the social compromise about embryos would be tragic. They also express considerable skepticism about whether the use of embryonically derived stem cells is necessary to achieve the kinds of health benefits proponents promise. They maintain that current research results indicate that stem cells whose source is bone marrow or umbilical cord blood may turn out to be just as valuable as human embryonic stem cells, notwithstanding the findings of groups such as AAAS and the National Bioethics Advisory Commission. But their primary concern is that human embryonic stem cell research, whatever its benefits might be, is gravely wrong. In their view, it involves the direct killing of innocent human beings.

#### Bioethics or Political Ethics

The challenge to those who hope to direct public policy on such matters is to find forms of argument that do not involve appeals to particular religious traditions or philo-

sophical positions. Charo calls the standard approach to this job bioethical. The strategy is to boldly take on the central argument about whether and when fetal life gains personhood or other kinds of moral status, to sort out what is rationally defensible in the arguments from what is not, and to construct and justify a position. To that end, policymakers use arguments that will resonate with a religiously and philosophically diverse population.

The Center for Bioethics and Human Dignity, whose position is clearly consistent with the official stance of the Roman Catholic Church, for instance, provides an argument that is not in any explicit way sectarian: it does not rely on an interpretation of religiously authoritative writing, nor on any religious teaching authority. The case stands on what are presented as biological facts and on reasoning by analogy from the historical record.

As the Center sees the matter, the pertinent biological fact is a supposed international scientific consensus that embryos are biologically human beings from fertilization, at which point there begins a continuous process of human growth and development. So smoothly incremental is this process that any effort to mark out a point after fertilization at which the developing entity goes through some change sharp enough to plausibly mark a morally relevant shift of status is simply arbitrary.

The Center's report is particularly vigorous in attacking the distinction many ethics boards have drawn between embryos and pre-embryos. The term pre-embryo denotes the human conceptus prior to the formation of the primitive streak, or first appearance of the spinal cord, about 14 days after conception. The development of the streak has been

seized upon as a morally significant threshold in fetogeny by an earlier federal advisory committee, the National Institutes of Health's 1994 Human Embryo Research Panel as well as by European bioethics commissions such as the United Kingdom's Warnock Commission, and is endorsed in the National Bioethics Advisory Commission stem cell report.<sup>5</sup> The Center for Bioethics and Human Dignity, however, regards the importance assigned to this distinction as biologically unfounded, and therefore as a non-starter, morally.

The Center's fundamental argument is that temptation to make any moral distinction between human life in its earliest phase and more developed versions should be stilled by a consideration of research medicine's dismal history of exploitation of the weak. The report invokes the use of slaves in the American South, the continuation of that legacy in the Tuskegee syphilis experiment scandal, and the experiments conducted by Nazis at Dachau and Auschwitz. The Center suggests that embryos are, in many respects, like American slaves or Jews in Hitler's Europe: the moral dignity they deserve is altogether ignored, and they are left vulnerable to the worst forms of exploitation.

This line of reasoning points clearly to a ban, not just on federally funded human embryonic stem cell studies, but on all destructive uses of embryos including embryos created *in vitro* for research or reproductive purposes.

#### Moral Threshold

As the ethics advisors to a corporation, Geron's ethical advisory board did not have to address the issue of federal funding. Nevertheless, Geron's board took on the task of responding to the argument that

embryos at all stages are human beings with all the rights accorded to them.

In the end, all four of these advisory bodies advocate what might be termed a pluralist, developmental understanding of moral status, in which the respect owing to fetal life is not determined abruptly either by fertilization or by its passing one or another developmental threshold, but grows in seriousness steadily throughout gestation.

This position is perhaps best developed in the 1994 NIH Research Panel Report on Human Research, which recommended that the federal government fund significant embryo research, but only if embryos were used sparingly and not beyond the 14th day of their development. In support of its view, it rejected the most prominent criteria that might mark embryos as fully morally protected beings—such events as conception, implantation, and inception of brain activity. The research panel argued that none of these criteria is sufficient to demonstrate that embryos, or any later state of the developing fetus, are to be regarded as human persons. The panel then claimed that the whole set of such criteria should be seen as incremental moral steps. Gestation's ethical story starts with the embryo, which ought not to be treated with disrespect but has no valid claim to a right to life—and concludes with the newborn child, which is fully a member of the moral community.<sup>6</sup>

Geron's advisory board takes a similar position based in part on the claim that progressive development toward full moral standing during gestation is congruent with the moral traditions of most mainstream Protestant churches, the Jewish tradition, and even with the views of many Roman Catholics,

although, as they note, not with the Vatican. Of course, this kind of argument does not so much tell us why we should accept a developmental account of the gradually increasing human status of the fetus, as inform us that many people do.

The National Bioethics Advisory Commission report endorses a view similar to that held by the bodies that advised the NIH and Geron. The commission characterizes its view as an intermediate position in which the embryo merits respect as a form of human life, but not as much respect as fully developed persons.<sup>7</sup> The board also implicitly assumes there's nothing so uncommon about its stand on the moral status of the embryo.

These bioethical approaches, Charo argues, are something of a mug's game—one you can only lose. For example, the 1994 NIH research panel report, to which Charo contributed, aimed to show that every criterion that designates a point at which embryos or fetuses have full moral status is unfortunately defective. Yet in trying to support its own developmental view, it merely mixed together all the criteria it had found unconvincing individually and claimed that, taken as a group, the passing of each threshold confers on the fetus a new ground for heightened respect. But it is hard to see how raking bad arguments into a pile makes them into a good argument.

#### Pragmatic Approach

Rather than argue about the timing or nature of personhood, Charo recommends an analytical approach that will justify the use of embryos as a last resort—in cases where there is no alternative—for purposes crucial to health and welfare.

The moral assessment of research involving human embryos should

proceed by asking hard questions concerning its potential to benefit and harm humankind. For example, how deeply might such research hurt citizens who believe that embryos are persons? What can be done to reduce their pain? How strong is the need to pursue this research? How certain are we that the research will yield real benefits? If embryo research is publicly funded, will the benefits go to those who oppose the research as well as those who support it? Is the research being pursued in the way least offensive to its opponents? How strongly felt are the objections? Will opponents be harmed physically or financially? Is there anything about the structure of society or its institutions that prevents opponents of such research from effectively using the political system to try to convince others? Would opposition to pursuing research deny human rights to anyone?<sup>8</sup>

Charo's position is similar to the kind of judicial deliberation that produced contemporary public policy concerning abortion. The U.S. Supreme Court maintained in *Roe v. Wade* that the federal government may not interfere with women's decisions to terminate pregnancies and may not allow states to block women's access to abortion services.

Yet the policy that has developed since *Roe v. Wade* has taken on a dimension of compromise. While states cannot deny access to abortions, they are not required to fund them. Presumably, the political philosophy rationale for shifting and extending this compromise respecting funding embryo research, while it may sidestep questions about the moral status of the fetus, will rely on claims that the good emerging from federally funded experimentation with embryos is more signifi-

cant than the good to be gained by allowing poor women subsidized access to abortion. This reasoning depends on a judgment call, that the losers in social disputes about public funding for abortion—poor women who can't afford abortions—suffer less than those who would be the losers in the research case, people who might remain ill or disabled longer should federal funding not be available.

So determining who would be hurt more than whom by different funding policies may not be so much easier than dealing directly with the embryo's moral status. For example, the Center for Bioethics and Human Dignity might argue that citizens opposing abortion are continually being outraged by the nation's policies. If what Charo suggests we do is spread pain around more fairly, why isn't it time for those who support federally funded embryo research to do their share of the suffering?

Further, it is unclear for now whether advisory groups weighing in on human embryonic cell research can really sidestep the central moral issue of the embryo's personhood. Erik Parens, in a paper prepared for the National Bioethics Advisory Commission's stem cell hearings, argued that government bodies cannot avoid taking a position on the moral status of the embryo. Parens points out that what we think is appropriate to do with things is to a large extent a function of what we think those things are. When an advisory body makes a policy concerning the disposition of embryos, it has already, in effect, made a determination about their moral status.<sup>9</sup>

The National Bioethics Advisory Commission report reflects this line of reasoning, admitting the near impossibility of skirting the issue of

the embryo's moral status. The commission claims that Charo's approach would be acceptable only to those who do not regard embryos as having the status of persons. Those who do think of embryos as persons will regard deciding their fate by weighing the harms and benefits befalling others as unacceptable.<sup>10</sup>

#### Public Participation

I have argued that the kinds of issues that Charo wants to place at the center of "public ethics" are not necessarily easier than those she wishes to avoid. Parens and the National Commission have argued that these issues are not truly avoidable. Even if Charo can show that moral status issues can be sidestepped and that weighing harms and benefits is easier, still we should not exclude the moral status issue from the deliberations of public ethics bodies. Attending respectfully to these arguments may, in fact, be our best chance to give those who lose out in social policy formation a sense that they are not being dismissed by a society that regards their moral concerns as merely idiosyncratic whims. To hear these arguments is not inherently socially divisive and practically vain. Instead, close, careful, respectful engagement with those who may consider themselves the losers in this debate may have the effect of improving their acceptance of the outcome.

It is a commonplace of the past few decades to remark that scientific advances have outstripped moral wisdom. The proliferation of ethics advisory committees deliberating painstakingly and publicly about extremely difficult issues represents an effort by society to play a good catch-up game. To be successful, we will need not only to encourage our advisory bodies to think

hard about the tough problems they confront, but to make the way in which they go about their task an object of our careful scrutiny as well. In examining how ethics advisory bodies have responded to the challenge of those intriguing entities, human embryonic stem cells, we have a prime opportunity to do just that. ■

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#### NOTES

1. "Stem Cell Research and Applications: Scientific, Ethical and Policy Issues" (August 18, 1999) is available at the AAAS website <<http://www.aaas.org/spp/dspp/sfrrl/projects/stem/findings.htm>>.

2. "On Human Embryos and Stem Cell Research: An Appeal for Legally and Ethically Responsible Science and Public Policy" is available at the Center website <<http://www.stemcellresearch.org/statement.htm>>.

3. National Bioethics Advisory Commission, *Ethical Issues in Human Stem Cell Research*.

4. A. Charo, "The Hunting of the Snark: The Moral Status of Embryos, Right-to-Lifers, and Third World Women," *Stanford Law and Policy Review* 6 (2) 1995.

5. NBAC, *Ethical Issues in Human Stem Cell Research*, p. 7.

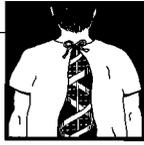
6. National Institutes of Health, *Report of the Human Embryo Research Panel* (Bethesda, MD: NIH, September 27, 1994).

7. National Bioethics Advisory Commission, *Ethical Issues in Human Stem Cell Research*, p. 68.

8. Charo, "The Hunting of the Snark".

9. Erik Parens, "What Has the President Asked of NBAC? On the Ethics and Politics of Embryonic Stem Cell Research," *Ethical Issues in Human Stem Cell Research*, vol. 2, forthcoming.

10. NBAC, *Ethical Issues in Human Stem Cell Research*, p. 51.



# A Stem Cell Primer

*What exactly are stem cells, which hold such great promise for advances in human health care, and how are they derived?*

BY KRISTINA BORROR, P. PEARL O'ROURKE, AND LANA SKIRBOLL

**R**ecent reports on the isolation and successful culturing of the first human embryonic stem cell lines have generated great excitement and brought biomedical research to the edge of a new frontier. The development of these cell lines deserves close scientific examination, evaluation of the promise for new therapies and prevention strategies, and open discussion of the ethical issues.

To understand the importance of this discovery as well as the related scientific, medical, and ethical issues, it is absolutely essential to first clarify the terms and definitions.

## Stem Cell Terms

■ **Totipotent.** *Stem cells*, which are cells that have the ability to divide for indefinite periods in culture and

to give rise to specialized cells such as blood or skin or brain tissue, are best described in the context of normal human development. Human development begins when a sperm fertilizes an egg and creates a single cell that has the potential to form an entire organism. This fertilized egg is *totipotent*, meaning that its potential is total—it can produce any kind of tissue found in the mature organism.

In the first hours after fertilization, this cell divides into two identical totipotent cells. This means that either one of these cells, if placed into a woman's uterus, has the potential to develop into a fetus. In fact, identical twins develop when two totipotent cells separate and develop into two genetically identical human beings. Approximately four days after fertilization and after several cycles of cell divi-

sion, these totipotent cells begin to specialize, forming a hollow sphere of cells, called a blastocyst. The blastocyst has an outer layer of cells; inside the hollow sphere is a cluster of cells called the inner cell mass.

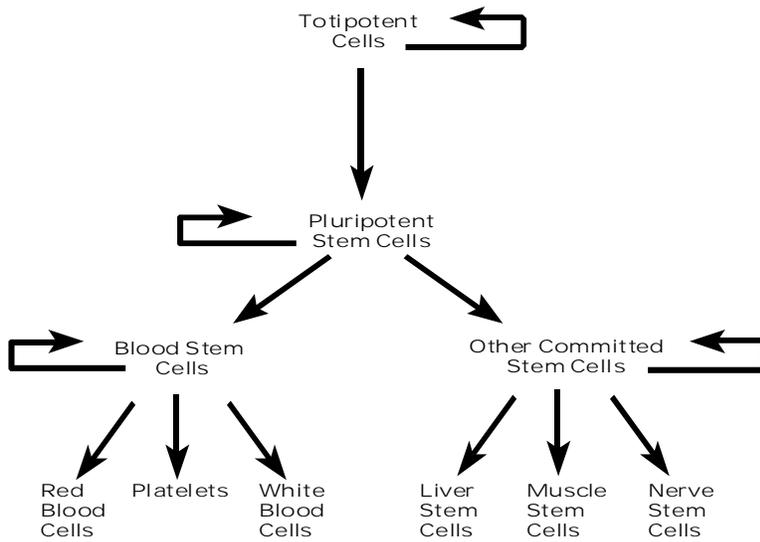
■ **Pluripotent.** The outer layer of cells will divide to form the placenta and other supporting tissues needed for fetal development in the uterus. The inner cell mass cells will eventually form virtually all of the tissues of the human body. Although the inner cell mass cells can form virtually every type of cell found in the human body, they cannot form an organism because they are unable to give rise to the placenta and supporting tissues necessary for development in the human uterus. These inner cell mass cells are *pluripotent*—they can give rise to many types of cells but not all types of cells necessary for fetal development. Because their potential is not total, they are not totipotent and they are not embryos. In fact, if an inner cell mass cell were placed into a woman's uterus, it would not develop into a fetus.

■ **Multipotent.** The pluripotent stem cells undergo further specialization into *multipotent* stem cells, which are committed to giving rise to cells that have a particular function. Examples of this include blood stem cells that give rise to red blood cells, white blood cells, and platelets; and skin stem cells that give rise to the various types of skin cells.

Note that the process of changing from totipotent to pluripotent to multipotent cells is not reversible—that is, pluripotent stem cells do not produce totipotent stem cells, and multipotent stem cells do not produce pluripotent stem cells. (Figure 1.)

While stem cells are extraordinarily important in early human development, multipotent stem cells are

Figure 1. Stem Cell Development



also found in children and adults. For example, consider one of the best understood stem cells, the blood stem cell. Blood stem cells reside in the bone marrow of every child and adult, and in fact, they can be found in very small numbers circulating in the blood stream. Blood stem cells perform the critical role of continually replenishing our supply of blood cells—red blood cells, white blood cells, and platelets—throughout life. A person cannot survive without blood stem cells.

#### Pluripotent Stem Cells

At present, human pluripotent cell lines have been developed from two sources with methods previously developed in work with animal models.<sup>1</sup>

In 1998, James Thomson and coworkers at the University of Wisconsin isolated pluripotent stem cells directly from the inner cell mass of human embryos at the blastocyst stage. Thomson received embryos from *in vitro* fertilization clinics, embryos that exceeded the clinical need for infertility treatment.

The embryos were made for purposes of reproduction, not research, and informed consent was obtained from the donor couples. Thomson isolated the inner cell mass and cultured these cells, producing a pluripotent stem cell line.

At about the same time, John Gearhart and coworkers at Johns Hopkins University isolated pluripotent stem cells from fetal tissue obtained from terminated pregnancies. Informed consent was obtained from the donors after they had independently made the decision to terminate pregnancy. Gearhart took cells from the region of the fetus that was destined to develop into the testes or the ovaries. Although the cells developed in these two labs were derived from different sources, they appear to be very similar.

The use of somatic cell nuclear transfer may be another way that pluripotent stem cells could be isolated. In studies with animals, researchers take a normal animal egg cell and remove the nucleus, the cell structure containing the chromosomes. The material left behind in

the egg cell contains nutrients and other energy producing materials essential for embryo development. Then, under carefully worked out laboratory conditions, a somatic cell—any cell other than an egg or a sperm cell—is placed next to the egg from which the nucleus had been removed, and the two are fused. The resulting fused cell and its immediate descendants are believed to have the full potential to develop into an entire animal and hence are totipotent. These totipotent cells will soon form a blastocyst. Cells from the inner cell mass of this blastocyst could, in theory, be used to develop pluripotent stem cell lines. Indeed, any method by which a human blastocyst is formed could potentially serve as a source of human pluripotent stem cells.

#### Potential Applications

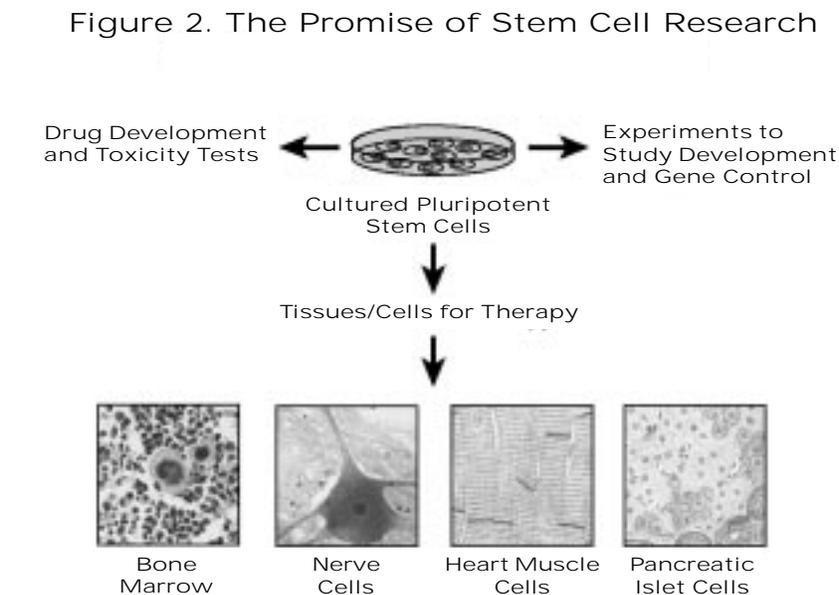
There are several important reasons why the isolation of human pluripotent stem cells is important to science and to advances in health care. At the most fundamental level, pluripotent stem cells could help us understand the complex events that occur during human development. A primary goal of this work would be to identify the factors involved in the cellular decision-making process that results in cell specialization. We know that turning genes on and off is central to this process, but we do not know much about these decision-making genes or what turns them on or off. Some of our most serious medical conditions, such as cancer and birth defects, are due to abnormal cell differentiation and cell division. A better understanding of normal cell processes will allow us to further delineate the fundamental errors that cause these often deadly illnesses.

Human pluripotent stem cell research could also dramatically change the way we develop drugs

and test them for safety. For example, new medications could be initially tested using human cell lines. Cell lines are currently used in this way—for example, new cancer drugs can be tested on cancer cells before being tried in human clinical trials. Pluripotent stem cells would allow testing in more cell types. This would not replace testing in whole animals and testing in human beings, but it would streamline the process of drug development. Only the drugs that are both safe and appear to have a beneficial effect in cell line testing would graduate to further testing in laboratory animals and human subjects.

Perhaps the most far-reaching potential application of human pluripotent stem cells is the generation of cells and tissue that could be used for so-called cell therapies. Many diseases and disorders result from disruption of cellular function or destruction of tissues of the body. Today, donated organs and tissues are often used to replace ailing or destroyed tissue. Unfortunately, the number of people suffering from these disorders far outstrips the number of organs available for transplantation. Pluripotent stem cells, stimulated to develop into specialized cells, offer the possibility of a renewable source of replacement cells and tissue to treat a myriad of diseases, conditions, and disabilities including Parkinson's and Alzheimer's diseases, spinal cord injury, stroke, burns, heart disease, diabetes, osteoarthritis, and rheumatoid arthritis. There is almost no realm of medicine that might not be touched by this innovation.

Transplant of healthy heart muscle cells, for example, could provide new hope for patients with chronic heart disease whose hearts can no longer pump adequately. The



hope is to develop heart muscle cells from human pluripotent stem cells and transplant them into the failing heart muscle in order to augment the function of the failing heart. Preliminary work in mice and other animals has demonstrated that healthy heart muscle cells transplanted into the heart successfully repopulate the heart tissue and work together with the host cells. These experiments show that this type of transplantation is feasible.

In the many people who suffer from Type I diabetes, the production of insulin by specialized pancreatic cells, called islet cells, is disrupted. There is evidence that transplantation of either the entire pancreas or isolated islet cells could reduce the need for insulin injections. Islet cell lines derived from human pluripotent stem cells could be used for diabetes research and, ultimately, for transplantation. (Figure 2.)

#### Technological Challenges

While this research shows extraordinary promise, there is much to be done before we can realize these in-

novations. Technological challenges remain before these discoveries can be incorporated into clinical practice. These challenges, though significant, are not insurmountable.

First, we must do the basic research to understand the cellular events that lead to cell specialization in the human, so that we can direct these pluripotent stem cells to become the type or types of tissue needed for transplantation.

Second, before we can use these cells for transplantation, we must overcome the well-known problem of immune rejection. Because human pluripotent stem cells derived from embryos or fetal tissue would be genetically different from the recipient, future research would need to focus on modifying human pluripotent stem cells to minimize tissue incompatibility or to create tissue banks with the most common tissue-type profiles.

The use of somatic cell nuclear transfer would be another way to overcome the problem of tissue incompatibility for some patients. For example, consider a person with progressive heart failure. Using this

technique, the nucleus of virtually any somatic cell from that patient could be fused with a donor egg cell from which the nucleus had been removed. With proper stimulation the cell would develop into a blastocyst: cells from the inner cell mass could be taken to create a culture of pluripotent cells. These cells could then be stimulated to develop into heart muscle cells. Because the vast majority of genetic information is contained in the nucleus, these cells would be essentially identical genetically to the person with the failing heart. When these heart muscle cells were transplanted back into the patient, there would likely be no rejection and no need to expose the patient to immune-suppressing drugs, which can have toxic effects.

#### New Horizons

As noted earlier, multipotent stem cells can be found in some types of adult tissue. In fact, stem cells are needed to replenish the supply cells in our body that normally wear out. An example mentioned previously is the blood stem cell.

Multipotent stem cells have not been found for all types of adult tissue, but discoveries in this area of research are increasing. For example, until recently it was thought that stem cells were not present in the adult nervous system, but, in recent years, neuronal stem cells have been isolated from the rat and mouse nervous systems. The experience in humans is more limited. In humans, neuronal stem cells have been isolated from fetal tissue, and a kind of cell that may be a neuronal stem cell has been isolated from adult brain tissue that was surgically removed for the treatment of epilepsy.

Until recently, there was little evidence in mammals that multipotent cells such as blood stem cells could change course and produce skin

cells, liver cells, or any cell other than a blood stem cell or a specific type of blood cell; however, research in animals is leading scientists to question this view.

In animals, it has been shown that some adult stem cells previously thought to be committed to the development of one line of specialized cells are able to develop into other types of specialized cells. For example, recent experiments in mice suggest that when neural stem cells were placed into the bone marrow, they appeared to produce a variety of blood cell types. In addition, studies with rats have indicated that stem cells found in the bone marrow were able to produce liver cells.

These exciting findings suggest that even after a stem cell has begun to specialize, the stem cell may, under certain conditions, be more flexible than first thought. At this time, demonstration of the flexibility of adult stem cells has been observed only in animals and limited to a few tissue types.

#### Adult Stem Cell Research

Research on human adult stem cells suggests that these multipotent cells have great potential for use in research and in the development of cell therapies. For example, there would be many advantages to using adult stem cells for transplantation. If we could isolate the adult stem cells from a patient, coax them to divide, direct their specialization, and transplant them back into the patient, it is unlikely that such cells would be rejected. The use of adult stem cells for such cell therapies would certainly reduce or even eliminate the practice of using stem cells derived from human embryos or human fetal tissue, sources that trouble many people on ethical grounds.

While adult stem cells hold real promise, there are some significant

limitations to what we may or may not be able to accomplish with them. First of all, stem cells from adults have not been isolated for all tissues of the body. Although many different kinds of multipotent stem cells have been identified, adult stem cells for all cell and tissue types have not yet been found in the adult human. For example, we have not located adult cardiac stem cells or adult pancreatic islet cells.

Second, adult stem cells are often present in only minute quantities and are difficult to isolate and purify, and their numbers may decrease with age. For example, brain cells from adults that may be neuronal stem cells have been obtained only by removing a portion of the brain of epileptics, not a trivial procedure.

Any attempt to use stem cells from a patient's own body for treatment would require that stem cells first be isolated from the patient and then grown in culture in sufficient numbers to obtain adequate quantities for treatment. For some acute disorders, there may not be enough time to grow enough cells to use for treatment. In other disorders, caused by a genetic defect, the genetic error would likely be present in the patient's stem cells. Cells from such a patient may not be appropriate for transplantation.

Research on the early stages of cell specialization may not be possible with adult stem cells since they appear to be farther along the specialization pathway than pluripotent stem cells. In addition, one adult stem cell line may be able to form several, perhaps three or four, tissue types, but there is no clear evidence that stem cells from adults—human or animal—are pluripotent. In fact, there is no evidence that adult stem cells have the broad potential characteristic of pluripotent stem cells. In order to deter-

mine the very best source of many of the specialized cells and tissues of the body for new treatments and even cures, it will be vitally important to study the developmental potential of adult stem cells and compare it to that of pluripotent stem cells.

#### Policy Prologue

The Department of Health and Human Services is prohibited by law from using any appropriated funds to create or destroy human embryos for research purposes. The National Institutes of Health asked the General Counsel of the Department of Health and Human Services to clarify whether research utilizing pluripotent stem cells is permissible under existing federal law governing embryo and fetal tissue research. After careful consideration, the DHHS concluded that because these cells are not embryos, current federal law does not prohibit funds from being used for research using human pluripotent stem cells.

The NIH understands and respects the compelling ethical, legal, and moral issues surrounding pluripotent stem cell research and is sensitive to the need for stringent oversight of this research—oversight that goes beyond the traditional rigorous NIH scientific peer review process. Three congressional hearings have been held on this topic, and the National Bioethics Advisory Commission has been asked by the president to conduct a thorough review of the issues associated with pluripotent stem cell research, including all ethical and medical considerations. We are seeking the in-

put of the public, Congress, and other interested groups as we develop our plan to oversee federally funded research in this arena.

On April 8, 1999, NIH convened a working group of the Advisory Committee to the Director to provide advice to the committee pertaining to guidelines and oversight for this research. The working group met in public session and included scientists, clinicians, the lay public, ethicists, and lawyers. During its deliberations, the group considered advice from the National Bioethics Advisory Commission, the public, and scientists. Draft guidelines for this research were published for public comment in the *Federal Register* on December 2, 1999. After reviewing and considering all comments received, the NIH will make revisions to the guidelines, as appropriate, and publish the final guidelines in the *Federal Register*.<sup>2</sup>

The NIH will not fund any research using pluripotent stem cells until guidelines are developed and widely disseminated to the research community and an oversight process is in place. All researchers currently receiving NIH support have been notified via the NIH website, NIH program staff, and the deputy director for intramural research that they cannot use DHHS funds for research using human pluripotent stem cells until further notice.

#### Great Expectations

Given the enormous promise of stem cells for the development of new therapies to treat the most devastating diseases, it is impor-

tant to simultaneously pursue all lines of research. Science and scientists need to search for the very best sources of these cells. When the sources are identified, researchers will use them to pursue the development of new cell therapies.

The development of stem cell lines—both pluripotent and multipotent—that may produce many tissues of the human body is an important scientific breakthrough. It is not too unrealistic to say that this research has the potential to revolutionize the practice of medicine and improve the quality and length of life.■

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#### NOTES

1. Michael Shamblo et al., "Derivation of Pluripotent Stem Cells from Cultured Human Primordial Germ Cells," *Proceedings of the National Academy of Science* (95) (November 1998), pp. 13726-13731; James Thomson et al., "Embryonic Stem Cell Lines Derived from Human Blastocysts," *Science* (282) (November 6, 1998), pp. 1145-1147.

2. The draft guidelines and other information on stem cell research can be found at <<http://www.nih.gov/news/stemcell/index.htm>>.

3. This article was adapted and updated from an article in the Summer 1999 issue of *National Forum: The Phi Kappa Phi Journal*.



# Empowerment or Danger

*We can now diagnose genetic disorders in a petri dish, but increased knowledge doesn't always bring increased wisdom.*

BY LAURA PURDY

In recent years, the options available to prospective parents have blossomed. Increasingly powerful diagnostic methods and new treatments have created a number of alternatives for those unable or unwilling to reproduce in the usual way. Each new development, from test-tube babies to surrogate mothers and sperm donors, also provides interesting fodder for ethicists.

These breakthroughs also elicit increasingly divergent judgments. Mainstream bioethicists do not appear overly concerned. Conservatives, however, fear these techniques will upset the established order, and some feminists believe they may harm or exploit women and children.

## Gene Screen

Preimplantation genetic diagnosis is one of the latest wrinkles in the rap-

idly developing field of reproductive technologies. A genetic counselor may recommend such diagnosis in cases where a couple is at risk for a harmful genetic condition that can be passed on by one parent, such as Huntington's Disease, or by a potentially dangerous or fatal combination of the parents' genes, such as that causing sickle cell anemia.

In general, diagnosing genes connected with specific diseases requires that an embryo be created outside the womb through *in vitro* fertilization. To increase the likelihood of a live birth, up to three embryos free of the problematic gene may then be implanted in the woman's uterus. Any extra embryos that show no signs of genetic problems may be frozen for later use in case the attempt is unsuccessful. Embryos carrying the problematic gene are discarded.

Preimplantation diagnosis, how-

ever, is just one approach for parents concerned about genetic risks. Other alternatives include:

- Going forward with pregnancy without any intervention and accepting the possibility of conceiving a child with an inherited disease;
- Preventing conception between partners and either adopting or remaining childless;
- Using a different reproductive technology to circumvent the problem, if it originates with one of the partners, such as donor insemination or contract pregnancy;
- Choosing prenatal diagnosis through traditional means such as amniocentesis with the option of aborting affected fetuses.

Given these alternatives, prospective parents and society in general could benefit from a moral assessment of preimplantation genetic diagnosis. Three issues are critical to such an assessment. First, preimplantation diagnosis raises issues that are specific to the techniques involved, which in themselves might cause harm to the developing embryo. Second, preimplantation diagnosis depends on *in vitro* fertilization, a procedure that raises its own moral issues, which have not received a great deal of attention by the mainstream in spite of the widespread use of the technologies. Third, preimplantation diagnosis raises the broad question of whether to perform prenatal diagnosis at all, either in a normal pregnancy or in the process of embryo implantation.

## First, Do No Harm

The central moral issue is whether the process of studying the genetic makeup of the embryo may harm the developing fetus and result in damage to the child.

Once the fertilized egg has become multicelled, one or two cells

are removed and studied for the relevant disease by examining their DNA, using a technique known as a polymerase chain reaction or by using a fluorescent dye. These cells are discarded after testing, but the worry remains whether developing embryos subsequently implanted in the mother are harmed by having cells peeled from them in this way.

Studies in mice and domestic animals suggest that the process is safe because each embryonic cell appears to have the potential to grow into a complete organism, so a few missing cells shouldn't make any difference. But how safe is the procedure? Long-term studies over several generations of animals are needed to support the view that the process is generally safe.

Only after this kind of evidence about the safety of culling cells from the embryo is available would it be a good idea to offer the procedure to people. Moreover, animal experimentation cannot tell us with absolute certainty the possible implications for humans. The application of new techniques to humans always involves a leap of faith, and there is little theoretical guidance for deciding when proceeding from animals to research on human subjects is morally justifiable.

In the absence of guidelines, theorists tend to fall into two camps regarding their attitude toward the risks involved in human-subject research. Members of the scientific community tend to be optimistic and believe in most cases the benefits outweigh the risks involved. Bioethicists and others who hail from the humanities are often more pessimistic about the benefits of new technologies and averse to taking unknown risks with human subjects.

It is undeniable, however, that preimplantation genetic diagnosis,

which is already available to people wanting to shape the destiny of their offspring, is experimentation without the subject's informed consent.

#### Risky Procedures

Consider the risks we already know about. Children born after preimplantation diagnosis bear similar risks to those from more traditional diagnostic techniques. For example, extracting fetal tissue with a needle—chorionic villi sampling—might cause long-term damage to the fetus. Amniocentesis, in which fluid is taken from the uterus with a needle, risks miscarriage and inadvertent damage to the fetus.

So far, children born after preimplantation diagnosis seem normal; however, there are relatively few of them, probably fewer than 100. It would be premature, therefore, to conclude from such a small sampling that the technique is harmless. Those who accept the thesis—proposed by philosopher Derek Parfit and lawyer John Robertson—that we do not harm offspring as long as they are not so miserable that they would prefer death, will probably feel comfortable with the technique. The rest of us need to be more concerned about the possibility of eventual harm.

Preimplantation genetic diagnosis, moreover, requires *in vitro* fertilization and therefore inherits other sets of moral and ethical problems that have yet to be resolved.<sup>1</sup> For example, *in vitro* fertilization has a low success rate, is costly, and risks direct or indirect harm to women and children. Worse still, from a moral point of view, the extent to which women who choose *in vitro* fertilization are informed about the risks is far from clear.

There is also considerable debate about the true success rate of *in vitro* fertilization, but it is possibly as low

as 10 percent live births for each single attempt, and some women undergo multiple attempts to conceive. The costs are high, about \$25,000 for each birth; that figure, however, underestimates the true cost. It fails to take into account the cost of failed treatment attempts, high risk obstetrical care in the case of multiple births, an increased risk of Cesarean sections, and intensive neonatal care for premature babies. The true costs of *in vitro* fertilization may range from \$66,667 to \$114,286—for younger women with few physical problems and spouses with healthy sperm—to \$160,000 to \$800,000 for women over 40 or for couples with male factor infertility.<sup>2</sup>

#### *In Vitro* Risks

What are some of the risks to women and children from *in vitro* fertilization? First, the process requires ovarian stimulation to produce a higher than normal supply of maturing eggs. Ovarian stimulation, which involves administering high doses of fertility hormones, is not risk-free. It can cause coagulation abnormalities; mild or lethal ovarian hyperstimulation syndrome; melanoma; and perhaps cancers of the breast, genitals, and ovary. Coagulation abnormalities can lead to thromboembolism, strokes, and myocardial infarction.<sup>3</sup> In addition, extracting eggs through the vagina or abdomen may cause bleeding, infection, or injury to blood vessels and viscera, and embryo transfer may expose women to infection.<sup>4</sup>

Other problems associated with *in vitro* fertilization are increased frequency of spontaneous abortions and ectopic pregnancy, increased first and second trimester bleeding, toxemia, fetal growth retardation, anemia, and pregnancy-induced hypertension.<sup>5</sup> Because the process

usually takes place in private fertility clinics and detailed data are not always available, it is currently unclear whether women are sufficiently warned about these potential problems or how seriously they are encouraged to take them.

In addition, there is relatively little discussion of the emotional consequences to women embarking on the process of *in vitro* fertilization, even though the emotional effects can be serious. The open-ended nature of the process—in which women hope for success on the first try but are often kept hoping during months of unsuccessful attempts—and the intrusive, uncomfortable procedures it requires constitute an emotional roller-coaster for many women. Again, it is far from clear how informed women are about its nature before they get on the roller coaster.<sup>6</sup>

If *in vitro* fertilization does produce pregnancy, there may still be trouble ahead, for it may vastly increase the risk of multiple births. Multiple births are risky for both women and babies. The risks include a higher incidence of preeclampsia, or toxicity of pregnancy; placenta previa, which can lead to hemorrhaging and death of the baby or woman; placental abruption, in which the placenta separates from the uterus prematurely; premature rupture of the membranes; post-partum hemorrhage; and Cesarean section.

Moreover, in older women, who are more likely to opt for *in vitro* fertilization because of decreasing fertility, the cardiovascular and renal systems may be unable to cope with the additional strain of multiple births, and babies born of higher order multiple births—triplets, quadruplets, or more—are almost 10 times more likely to perish than singletons, or solitary births.<sup>7</sup> Because they are also much more

likely to be premature, these babies suffer from the many problems associated with low birth weight and are much more likely to need respirators, intravenous feeding, and other costly treatments.<sup>8</sup> Prematurity is also associated with significant lifetime disability.

The problems caused by multiple births lead to additional interventions, with their own risks and ethical quandaries. For example, women with higher-order multiple births may be offered reduction of some of their fetuses. However desirable its intended consequence, reduction increases the risk of losing the entire pregnancy, may be emotionally difficult for women, and raises the abortion issue.<sup>9</sup>

Why might one doubt that women are truly informed about the risks and ethical quandaries of *in vitro* fertilization? First, it is unclear whether they understand how unlikely they are to come away with a live baby.<sup>10</sup> It should be easy to develop standards for reporting success in simple terms potential parents can understand, for example, the number of live, week-old babies per completed cycle of the technique. Yet clinics still present confusing statistics—such as the percentage of “biochemical pregnancies,” or conceptions that may be confirmed early in the pregnancy through a blood test, but that may or may not result in live birth—that are irrelevant to a woman’s goal of taking home a live baby. This practice is morally dubious.

Second, if patients are unclear about the probability of conceiving easily, then their decision is uninformed. For the most part, *in vitro* fertilization is not provided for by public health agencies or covered by the average health insurance policy, so prospective parents may spend a considerable amount of their own

money on a treatment with a doubtful success rate. When health insurance and public health funds may also be used to pay for *in vitro* fertilization, this may not be an efficient use of such resources. At a time when other, essential services such as prenatal care are being cut or rationed, the allocation of scarce resources becomes a moral issue. Last but not least, many women seem ready to do anything to have a baby, and it’s far from clear how seriously women heed the potential physical risks to themselves and their resulting babies.

Preimplantation genetic diagnosis also raises a number of issues common to all forms of prenatal testing. There is, for example, the issue of false negatives and false positives, which can cause false alarms or give a false sense of security. Another problem concerns the implications of prenatal diagnosis for siblings who have, or are at risk for, the disease that is being tested for. For example, an older child, knowing his parents are “weeding out” embryos that are not perfect, might feel psychologically vulnerable or even imagine his parents would like to be rid of him as well. It’s also hard to know where to draw the line between conditions that should be tested for such as Tay-Sachs—which causes convulsions, blindness, and mental retardation soon after birth and leads to an early death—and those that should not, such as myopia. Some feminists also argue that prenatal diagnosis exploits and coerces women by penalizing the preference not to test.

#### Right to Life?

The primary goal of preimplantation diagnosis is to identify genetic disorders; therefore, it is understood that defective embryos will be discarded. Disability rights activists

argue that attempting to prevent the birth of disabled children discriminates against the existing disabled population as well as the unborn, and they therefore oppose genetic diagnosis.

The objections of some of these activists seem unfounded.<sup>11</sup> To hold that failing to bring disabled or ill children into the world is discriminatory depends on the assumptions that potential humans already exist and that unborn fetuses at any stage of development have the full range of rights afforded to children and adults. Nevertheless, they argue that preventing such births, either through abortion or through selecting for normal embryos, undermines the self-respect or the rights of existing persons with disabilities.

This argument seems to me to be founded on a mistaken confusion of the self and its properties. For parents to choose to increase the odds of a healthy baby should not in itself damage the self respect of the existing disabled, nor is it a form of discrimination against them.

Some who object to preimplantation diagnosis on the grounds of disability rights rely on the distinction between failing to conceive and abortion. First, no one would argue against attempts to make sure fetuses are born healthy and unimpaired, for example, by ensuring that pregnant women get enough folic acid. But if there is no serious moral difference between failing to conceive and aborting an existing fetus, the disability rights arguments would have to reject efforts to prevent conception just as they reject selective abortions.

Second, consider this thought experiment. Suppose that before conception we could put in an order for our children's desired characteristics. Imagine a checklist of features that many of us would pre-

fer our children not have. These range from the serious such as Tay-Sachs disease to the non-life threatening such as blindness, cleft palate, or club feet. Would anything be wrong with failing to order up these conditions? If not, then it seems that the objections of disability rights advocates depend on positing a moral difference between failing to conceive and aborting, or perhaps on some alleged moral difference between action and omission.

Third, some feminists object that women's interests may automatically be considered subordinate to the interests of the fetus when fetal welfare is really or potentially at risk. They may be pressured to undergo diagnostic tests despite the physical and emotional risks, and it is women who must deal with the consequences. Feminists also rightly emphasize that health, including children's health, could be improved more effectively in many cases by preventive social measures such as feeding programs, better prenatal care, environmental cleanups, and more generally, by eradicating poverty than by exotic genetic testing.

#### Abortion

Enthusiasm for preimplantation genetic diagnosis depends to some extent on judgments about the morality of abortion. Those who believe that conception marks the beginning of life will see no more benefit to such diagnosis than to prenatal diagnosis in general, since both may lead to the death of organisms with a right to life. In fact, preimplantation diagnosis might be seen as morally worse since it is likely to cause more deaths, for example when ovarian stimulation is used to collect more eggs that will be fertilized but not implanted. Moderates who believe that the value or moral status of the fetus

increases over time will probably prefer preimplantation diagnosis to prenatal diagnosis followed by abortion. All things being equal, those who oppose abortion at any stage of pregnancy will likely see no need or moral rationale for any sort of genetic diagnosis on the grounds that all fetuses have the right to be born, no matter how serious their risk of genetic disease.

Are all things equal? That seems doubtful. As long as preimplantation diagnosis require *in vitro* fertilization, it may be morally inferior to ordinary prenatal diagnosis followed by abortion of affected fetuses primarily because of the increased potential for harm to women from *in vitro* fertilization. But another factor enters the moral equation: preimplantation diagnosis, if successful, circumvents the need for abortion.

The moderate view is that circumventing abortion is clearly desirable because of moral concern about fetuses. Strong opponents of abortion would concur, for other reasons, that it is better to avoid abortions. Both groups recognize that it can be very painful for women to have late-term abortions of unwanted pregnancies, and the prospect of repeated abortions of this type is especially painful. Therefore, women face a trade-off between fairly immediate suffering from such abortions versus the rather ill-defined future risk from *in vitro* fertilization.

#### Whose Choice?

In the last decade or so, the paternalistic model of the patient-physician relationship in which the doctor makes the decisions has been supplanted by a *laissez-faire* system in which patients are informed about the possible risks and benefits of various alternative approaches

and are invited to make their own decisions about the course of their care. However, many bioethicists now believe we need to modify the laissez-faire approach. Some patients may have trouble making sensible decisions because they are anxious or in pain, and laissez-faire autonomy may leave vulnerable patients without needed guidance. For example, some researchers have recommended a model of the patient-physician relationship that encourages patients to clarify and articulate their own views.<sup>12</sup>

Others suggest in addition that patients may benefit from physicians' help in reasoning through their options by pointing out implications of their beliefs as well as inconsistencies among them.<sup>13</sup> For example, if a mother who is adamantly opposed to abortion is confronted with the information that a severely disabled child may even outlive the mother, that information might radically affect her decision.

While physicians may not have the right to make the final decision, they may at least voice their disagreements with patients' decisions.<sup>14</sup> Such discussion protects patients by alerting them to physicians' views—views that might otherwise emerge as unconscious bias in the way options are presented—and encourages patients to grapple with the objections to their own positions. Some would argue for an even more active role in certain situations, including these reproductive contexts. This approach can lead to patient empowerment and to a more robust conception of autonomy: autonomy as empowerment.<sup>15</sup>

A more active approach may be especially desirable for patients who are leaning toward preimplantation diagnosis, for several reasons. First, it is often more difficult than health providers might believe for patients

to sort out the options, especially when they may well be in the grips of strong emotions, and the consequences of their choices can be momentous.

Second, the social pressures on women making reproductive decisions can be powerful, and they may benefit enormously from help in sorting out their own feelings, values, and attitudes. These pressures include a strong cultural bias encouraging women to have children, sexist attitudes that hold women's welfare secondary to the welfare of the next generation, a bias toward families carrying on their genetic heritage through families, negative attitudes toward abortion, and the tendency to discount future harms of the diagnostic procedure, such as a possible risk of ovarian cancer.

Suggesting that women may benefit from expanded, gender-specific counseling does not rest on any presumption of women's incompetence; it simply recognizes the many and conflicting pressures on them.

What does such a proposal amount to in practice? Physicians are as likely as their patients to be influenced by the social and cultural assumptions I have listed. Even if they aren't, most busy physicians are not likely to make time to work with patients in this way.

An alternative would be for physicians to explore their own assumptions about these issues so they can be aware of the bias with which they present information about reproductive options. Unfortunately, helping women examine and critique their values in a respectful way requires time and considerable skill and probably needs to be done by specially trained individuals.

#### Best Options

Given my view of the modest moral standing of fetuses and my assess-

ment of the risks of preimplantation genetic diagnosis, *in vitro* fertilization, and intracytoplasmic sperm injection, I'm inclined to believe that if a woman is already determined to have *in vitro* fertilization for other reasons, or if she is adamantly opposed to abortion and unwilling to consider other possible approaches if there is a known risk of serious disease or disability, preimplantation diagnosis is not only morally acceptable, but the best option. However, I believe that most women would be better off using other alternatives, including prenatal testing plus abortion, despite the potential for suffering that may be involved. I believe there can be high costs facing women who risk having children with serious health problems, and I hope that less invasive and costly approaches to avoiding this situation can be found. In the meantime, extensive counseling could help individual women determine which course of action comes closest to satisfying them at a cost they are prepared to pay, emotionally, physically, and financially.■

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#### NOTES

1. See Michelle Mullen, Affidavit in the matter of DR and LR, BC and LAC, BL and RF, LE and ME, JH and ICH (Appellants) and the General Manager (Respondent) and the Attorney General of Ontario (Intervenor) Health Services Appeal Board, heard July 1998.

2. Robert H. Blank, "Assisted Reproduction and Reproductive Rights: The Case of In Vitro Fertilization," *Politics and the Life Sciences* 16 (2) (September 1997), pp. 284-85.

3. *Ibid.*, p. 285. See also Helen B. Holmes, "In Vitro Fertilization: Reflections on the State of the Art," *Birth* 15 (3) (September 1988), pp.134-45. Holmes suggests that problems caused by ovarian stimulation are probably underreported because there is little follow up of women who have undergone *in vitro* fertilization (p. 136). There is little reason to think that the situation is any different in 1999.

4. Blank, "Assisted Reproduction and Reproductive Rights," p. 285. For a fuller discussion of risks, see Holmes, "In Vitro Fertilization."

5. *Ibid.*, p.287.

6. See Holmes, "In Vitro Fertilization," p. 141.

7. Singletons' mortality rate is seven to 23, triplets 70 to 140, and quadruplets 100 to

170 per 1,000 births; Blank, "Assisted Reproduction and Reproductive Rights," p. 286.

8. *Ibid.*, pp. 286-87.

9. *Ibid.*, p. 286; Christine Overall, "Selective Termination in Pregnancy and Women's Reproductive Autonomy," *Issues in Reproductive Technology*, Helen B. Holmes, ed. (NY: New York University Press, 1994); Mary V. Rorty, "Feminism and Elective Fetal Reduction," in *Embodying Bioethics: Recent Feminist Advances*, Anne Donchin and Laura Purdy, eds. (Lanham, MD: Rowman & Littlefield, 1998).

10. See Donna E. Stewart et al., "The Disconnect: Infertility Patients' Information and the Role They Wish to Play in Decision Making," submitted for publication, p. 4.

11. "Loving Future People," in *Reproduction, Ethics, and the Law*, Joan Callahan, ed.

(Bloomington: Indiana University Press, 1995); reprinted in L. Purdy, *Reproducing Persons* (Ithaca, NY: Cornell University Press, 1996).

12. Ezekiel J. Emanuel and Linda J. Emanuel, "Four Models of the Physician-Patient Relationship," *Journal of the American Medical Association* 267 (16) (April 22-29, 1992), pp. 2221-2226.

13. J. Andre, Letter, *Journal of the American Medical Association* 268 (1) (1992), pp.1411-12.

14. T.E. Quill and H. Brody, "Physician Recommendations and Patient Autonomy: Finding a Balance between Physician Power and Patient Choice," *Annals of Internal Medicine* 125 (9) (1996), pp. 763-69.

15. Virginia Warren, "From Autonomy to Empowerment: Health Care Ethics From a Feminist Perspective," in press.



# Banking on the Future

*The choices made about the collection, storage, and use of umbilical cord blood raise complex ethical issues.*

BY JAMIESON BOURQUE AND JEREMY SUGARMAN

**T**he emergence of new biomedical technologies that promise to improve or prolong life naturally sparks tremendous excitement. However, before we adopt cutting-edge technologies, we need to examine the scientific realities and ethical implications of such technologies.

Ideally, ethical considerations should be addressed, in tandem with scientific considerations, to enhance the likelihood that new biomedical technologies are appropriately adopted.

The collection and storage of umbilical cord blood as a potential source of stem cells for transplantation is a case in point.<sup>1</sup> In recent years, researchers have been exploring the medical uses of umbilical cord blood for treating certain types of cancer and other disorders.

However, the ways in which this biological material might be used for research and treatment have ethical implications. For example, what are the benefits and pitfalls based on whether research is done in private or in the public sector? Who should control the use of umbilical cord blood? Where and how should it be banked, in public or private institutions? Who should have access to data obtained from medical testing done on donors, mothers, and banked cord blood? When and how should informed consent be obtained?

While some practical solutions to such questions have already been developed, the ethical issues associated with them remain important. In order to understand these issues, however, it is important to have a basic understanding of the collection, storage, and use of cord blood.

## Background

Umbilical cord blood is collected after the newborn infant has been completely delivered and the umbilical cord has been cut. In the past, delivery room personnel would typically collect umbilical cord blood for routine testing and then discard the rest as medical waste or save it for medical research. This research led to the discovery that umbilical cord blood has a high concentration of stem cells, undifferentiated cells with the potential to form a number of more specialized blood cells. Now, these stem cells can be used instead of bone marrow for transplantation to treat many conditions, including some types of cancer and genetic disorders.

Unlike stem cells collected from a donor's bone marrow, umbilical cord blood cells do not seem to stimulate a vigorous response from the immune system to reject them. This characteristic might make umbilical cord blood a good substitute for bone marrow in transplantation. Furthermore, using umbilical cord blood as a source of stem cells for transplants eliminates the need for donors to undergo the risk and discomfort of bone marrow harvesting.

Prior to transplantation, umbilical cord blood is tested to make sure it is compatible with the recipient and free of evidence of certain infectious and genetic diseases that might be transmitted to the recipient. Since there is usually very little medical information about the donor—the newborn infant—to further minimize the risk to recipients, the donor's mother is also tested for certain diseases and asked a variety of questions about her medical, sexual, and drug-use history.

To date, hundreds of transplants using cord blood have been successfully performed.<sup>2</sup> Most transplanta-

tions are performed with umbilical cord blood that has been stored, or banked. Currently, umbilical cord blood is stored in both public and private banks. In the handful of public banks located across the country, umbilical cord blood is stored for use by anyone who needs it and is typically collected and stored for free. Families who want umbilical cord blood stored for their personal use typically pay private banks to store it. Banks use a variety of techniques in recruiting and marketing, including websites, videos, and information given to obstetricians.

#### Property, Waste, or Gift?

Other biological materials such as blood are also maintained in a similar mix of public and private banks. Patients who may need a blood transfusion in the future, for example, may in some settings bank that blood for their own use.

For many biological materials, especially solid organs used in transplantation, however, a public model is the rule. There is no private market for solid organs. While the reasons for this are complex, treating human biological materials as property to be bought or sold raises important moral questions related to whether these biological materials should be regarded as personal property, medical waste, or something so distinctive that if it is to be used, it must be given as a gift.<sup>3</sup>

Although metaphors such as property, waste, or a gift may at first seem trivial, these terms have substantial effects on how cord blood can be transferred and who has primary control over it. For instance, if it is considered property, it can be sold; whereas if it is considered something to be donated as a gift, profit is not allowed.

In fact, many biological materi-

als—surgically removed gall bladders or appendices, for example—are considered waste. Hospitals are responsible for the material and either dispose of it as biological waste or find some other use for it such as teaching or research. Until relatively recently, umbilical cord blood has been treated as waste that was disposed of by hospitals or recycled for use by researchers or cosmetic companies at some profit for hospitals.

This use of biological materials in general, and umbilical cord blood in particular, for intellectual or financial gain suggests that the waste analogy is imprecise. Rather, considering the potential value of umbilical cord blood in the treatment of human disease, a more accurate analogy might be that of property. Thus, the owner would have control over how it is used. Nonetheless, designating umbilical cord blood as property can create competing claims of ownership; for example, does it belong to the person from whom it comes, or to the hospital where it was taken, or to the bank that stores it.

Nevertheless, treating cord blood as property neglects more fundamental questions about whether biological material ought not be treated as a commodity, but rather as something so distinctive it should be treated as a gift.<sup>4</sup>

Private banks have considered umbilical cord blood as property owned by the infant or the child's parents, simply because it's the infant's blood they are storing. However, these banks may claim ownership, should storage fees not be paid.<sup>5</sup> In addition, experience with tough cases involving the disposition of frozen embryos in private fertility clinics serve as a reminder that there can be ownership disputes about biological property.

Accordingly, it has been suggested that banks and donors would be wise to draw up advance agreements concerning the disposition of umbilical cord blood in the event of extenuating circumstances—such as the death of the donor or a default in payment for storage fees—to avoid potential conflicts.<sup>6</sup>

In contrast, public banks have taken the stance that umbilical cord blood ought not be considered property, just as solid organs are not considered property. Accordingly, public banks assume that umbilical cord blood will be treated as a gift, like solid organs such as kidneys or livers.

Thus, in dealing with biological materials, there is considerable uncertainty about just what umbilical cord blood and other biological materials really are. Should we treat such biological materials as something to be owned, or as property, or as a sacred component of what makes a person human? Are there relevant distinctions in this determination based on whether they are separated from the person or must be harvested from the person? Likewise, is there some critical difference between reproducible materials such as blood or nonreproducible materials such as umbilical cord blood?

#### Private and Public Science

Some of the early work with umbilical cord blood, including the first transplantation, was made possible by efforts in the private sector. Since entrepreneurship is highly prized in our society, it is not surprising that private banks sprang up, assuming that umbilical cord blood is property. Yet as discussed above, it is unclear whether such an assumption can be justified. Moreover, it is ironic that while private funding played an important role in the development of this technology,

the long-term effects of continued work in the private sector are uncertain. For instance, given their investments, private companies maintain a proprietary interest in the technology being developed and therefore may have an incentive not to allow their scientists to share results. It is easy to see how this approach might lead to the duplication of work and slow overall scientific progress. In addition, rapid development of new biomedical technologies in the private sector makes it hard to keep pace with potential ramifications.

In contrast, public funding of basic research can be difficult to obtain, precluding development of some promising technologies. Further, research in the public sector can be cumbersome, with both research and development progressing slowly.

#### Fairness in Banking

The types of banks established also raise questions about fairness. For example, umbilical cord blood saved in private banks may not be accessible to all members of society simply because some might not be able to pay for banking services. Of course, this issue is by no means unique to umbilical-cord-blood technology, but is part of the larger debate about access to health care.

Nevertheless, in public banks developed with federal funds, equality of access among members of all races, ethnic groups, and socioeconomic statuses must be assured.<sup>7</sup> Fairness in use assumes fairness in collection; that is, no one single group should be singled out for collection over another. Donors must be recruited from a wide demographic range so that a diverse range of potential recipients can have well-matched umbilical cord blood.<sup>8</sup> This balance of collection among

different groups can be achieved through frequent and consistent reviews of the donor recruitment process. Recruiting strategies must be carefully constructed so that certain groups are not alienated or discriminated against. For example, labeling umbilical cord blood as experimental could discourage some African-Americans from participating due to mistrust and suspicion of the medical and research communities based on historical abuses such as the Tuskegee Syphilis Study.<sup>9</sup>

#### Sensitive Information

In umbilical cord banking, the mother's blood is tested for diseases that could be transmitted to the recipient through the donated umbilical cord blood. The risk of discrimination must be considered in performing medical testing for potentially stigmatizing diseases. For example, donors and their mothers may test positive for infectious diseases such as HIV-infection and genetic diseases such as sickle-cell anemia. The implications of these results can be profound. For instance, if a donor's mother is informed of a positive test, she may be obligated to inform her insurance provider, resulting in changes in her coverage. The donor could also experience difficulties in obtaining new health insurance, life insurance, housing, or even employment as a direct result of screening.

Because of the sensitive nature of this information, measures to ensure confidentiality are therefore important. To maintain this confidentiality, guidelines are needed to decide how close a connection will be maintained between test results and the identity of the donor.<sup>10</sup>

Erasing any link between the blood and the donor would guarantee the privacy and confidentiality of the mother concerning medi-

cal information, including diseases that may be identified in the process of testing. Some mothers might not want to know the results of these tests.<sup>11</sup> If a mother does not want to know this information, then it violates her autonomy to force it on her. However, these principles must be balanced against the equally important duty to notify people of diseases that affect their welfare.

There are other privacy concerns that arise when umbilical cord blood is banked. For example, after cord blood has been banked and used to treat a patient, albeit unsuccessfully, doctors might determine that more stem cells from the same donor may offer a potential life-saving therapy for the recipient, but there may no longer be stem cells in the bank. Should the original donor then be asked to donate blood marrow for the recipient? Is the medical need of one person reason enough to violate the privacy of the other? If so, when should contact occur and under what circumstances? Cord blood banks should anticipate these difficult and complex ethical dilemmas and decide in advance how they will handle such tough cases.

#### Informed Consent

The rapid emergence of umbilical cord blood technology required the equally swift development of approaches to its banking and use. Specifically, informed consent must be obtained from donors for the banking of umbilical cord blood. While informed consent is now an accepted part of health care and health-related research with human subjects,<sup>12</sup> when research on cord blood was just beginning, many researchers assumed that informed consent was unnecessary because umbilical cord blood was waste to be discarded. However, as umbilical cord blood showed therapeutic

promise, the need arose to obtain sensitive health-related information about the donor, and the calculus shifted towards requiring informed consent.

For informed consent to be valid, a person must be well informed and competent to make a decision and must not be coerced or pressured in any way. In addition, relevant information must be given at the proper time, that is when the individual is able to think about this information. Informed consent must include a description of the procedure, a discussion of the possible short and long-term benefits and risks of the procedure, alternatives to collection, and any procedures that will or might become necessary, such as testing the mother to ensure that the umbilical cord blood does not harbor infectious diseases.<sup>13</sup> Donors should also be made aware of any other possible issues that could arise from this testing, such as a positive test for HIV-infection and the potential for discrimination based on test results.

Informed consent should be obtained weeks in advance, instead of during the tumultuous moments preceding or following delivery.<sup>14</sup> Asking in advance also gives parents the time to ask questions and discuss their options.

#### Oversight of Innovation

The choice of whether to classify the use of cord blood as an experimental approach or as a new, but established, therapy has also been a matter of continuing debate. Classifying cord blood as experimental provides some additional protections for donors and recipients, including prior review by institutional review boards and oversight by the Food and Drug Administration. But

there has been some resistance on the part of private industry to endorse such a classification. Private banks argue that there are sufficient data to exempt the use of umbilical cord blood from these restrictive approaches required for experimental treatments. While it is important not to overburden new technologies with heavy restrictions, there are potential hazards of using untested procedures. The new therapies may be harmful, or they just might not be helpful.

#### Implications

Umbilical cord blood collection and storage offers a good example of the social and ethical complexities associated with the emergence of new biomedical technologies. In order to enhance the likelihood of continued development of new biomedical technologies that are safe, effective, and implemented in an appropriate manner, there is a clear need to address the ethical issues these technologies raise in concert with their development. Policymakers need to build on the strengths of industry and academia and strike a balance between rapid development of technologies and the needs and interests of those individuals who stand to gain or lose in the process.■

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# No Patents on Life

*Patents on genetic information have little to do with the public good and much to do with private greed.*

BY NICHOLAS HILDYARD AND SARAH SEXTON

**M**ost people assume that their bodies are their own—and no one else's. They assume that their blood is theirs, unless they care to donate some of it. They assume that their kidneys, eyes, spleens, and hearts are theirs and will go with them to their graves unless they choose to give them to others. They might also assume that their genes—the inherited biological material inside each of their cells—are their own.

But in many countries, including the United States and the United Kingdom, they could well find themselves on the wrong side of the law. Over the last 20 years or so, laws have gradually changed to allow companies or individuals to patent bacteria, animals, plants, isolated human genes, and body parts after they have been removed from

the body. Once patented, these all effectively become the property of the patent holder.<sup>1</sup>

There is intense public concern over the ethical and social implications of this trend in legislation, which is currently being challenged in Europe. A survey published by the polling firm Eurobarometer in June 1997, for example, reveals a deep ambivalence among the European public about much of modern biotechnology. What worries people most is not the potential risk to the environment or human health—risks that are in fact substantial—but the morality that turns isolated parts of people and living organisms into property for others to profit from.

## Patenting Life

Until recently, patents have primarily been granted for mechanical inventions—not living things. But

with the advent of new genetic engineering techniques—particularly that of transferring genes between totally unrelated species of plants, animals, or microorganisms—biotechnology companies and university researchers have applied for and in some cases been awarded patents not only on the processes to isolate and characterize genes but also on the genes themselves. As a group of British scientists pointed out in 1997, “If this principle had been applied in chemistry, the elements would have been patented.”<sup>2</sup>

The patents on living organisms granted under existing patent law in Europe have generated much controversy and provoked drawn-out legal challenges. For instance, a wide range of medical and other groups challenged a patent granted by the European Patent Office to Biocyte, a U.S.-based company, on umbilical-cord blood cells from fetuses and newborn babies. The patent gave the company complete control over the extraction and use of the cells and over any therapies developed in connection with them. In addition, the cells can be used without permission of the donors or their mothers.

Because of challenges and delays like this, the biotechnology and related industries have pushed hard for the patenting system explicitly to encompass living material. Thus, European Union legislation passed in May 1998, but which is not yet in force, effectively defines a gene not as a discovery, which cannot be patented, but as an invention, which can. If this legislation is enacted, it could severely curtail the scope for future challenges to patents on life.

The genes associated with disorders such as cystic fibrosis and diabetes could become the property of a multinational drug company. This

means that members of the public who undergo genetic screening to see whether they are affected or not would have to pay a royalty to the company that owns the patent on the genes because the test uses the gene.

#### No Patent, No Cure?

In Europe, public unease over genetic engineering has grown in recent years. The European biotech and pharmaceutical industries are responding by insisting that without the protection a patent affords, companies would be unwilling to invest hundreds of millions of dollars in developing biotech products.<sup>3</sup> Potentially beneficial discoveries would therefore either not be made at all or would just languish in the laboratory and never find their way to the market to benefit those potentially affected by genetically inherited disorders. In effect, they claim: no patents, no cures.

However, numerous groups that work with or represent people with genetically inherited disorders—those who might have the most to gain from the new technology—wholeheartedly reject this view. Far from promoting such research, they argue that patenting genes actually hinders scientific inquiry and undermines medical progress. In Great Britain, for example, the Regional Genetic Service of the Central Manchester Healthcare Trust, a program administered by the National Health Service, fears that a biomedical company that has isolated a gene and then been granted a patent on that gene would be able to control all future research and medical developments involving that gene. Such control kills, rather than fosters, research, the Trust believes.<sup>4</sup>

Other health care professionals in the United Kingdom point out that most genetic research has been funded largely by the public sector.

The free flow of information among government and charity organizations is threatened by gene patents.<sup>5</sup>

#### Hindering Research

Those who oppose the patenting of genes and living organisms warn that patents in science promote secrecy prior to the granting of a patent and hinder the free exchange of ideas and information necessary for cooperative scientific effort. Biotech companies are in business primarily to make a profit, and their drive to gain exclusive access to discoveries promotes an atmosphere of secrecy, says U.S. biochemist Arthur Kornberg of Stanford University, who has worked with a variety of biotech companies for 25 years.<sup>6</sup>

These threats are very real, particularly at a time when university scientists are being encouraged—or compelled by restricted public funding—to find industrial sponsorship for their work. Researchers, for example, may find companies reluctant to pay for their work if a key element of the basic knowledge involved is already controlled by a competitor.

In other cases, research organizations—both public and private—that have been the first to isolate a gene may restrict the terms under which other scientists continue to work with that gene. Already, British charities that have spent millions of pounds on research into cystic fibrosis and breast cancer face the prospect of paying royalties to American or Canadian research groups—even though the successful genetic discoveries of these groups were built on the work of the whole research community.

In addition, many scientists who don't agree that genes and living organisms should be patented feel obliged to do so because if they don't, others could patent their

work. In addition, they could find themselves paying royalties to patent holders yet not receive royalties themselves.

As Professor Martin Bobrow, formerly at Guy's Hospital, London, has said, "We, and many other university departments and public research institutions, are having to spend money taking out patents because we cannot afford not to."<sup>7</sup>

For poorer countries in the Third World, the impacts of patenting are likely to be especially severe. As Piet Bukman, who was responsible for development cooperation at the Dutch Ministry of Foreign Affairs in 1989, has noted, "A fence is being built around biotechnological know-how, which can only be opened from the inside."<sup>8</sup> And it is the developed countries that hold the key.

Scientists are also concerned that, as the research agenda becomes increasingly commercialized—a process greatly enhanced by patents—funds will be channeled into commercially profitable ventures rather than into research for the public good.

The quest for patentable products targeting human genetic disorders is also likely to divert much-needed funding from research into preventative health measures—such as minimizing exposure to industrial and other pollutants—that would benefit the public but bring few profits to biotechnology corporations. It has been estimated, for example, that at least 90 percent of human breast cancers are unrelated to breast cancer genes but are triggered by environmental pollutants, diet, and lifestyle factors. The search for a technofix, however, means that alternative approaches to reducing disease get little or no funding.

#### Curbing Competition

Patent law, as it currently stands, not only allows monopoly control

of new technologies and processes but actively endorses such powers. Far from encouraging competition, and thus new research, it inhibits it. This is especially true for broad spectrum patents that cover *all* genetically engineered species—for instance all genetically engineered cotton, soybeans, or cattle, no matter what the gene spliced into the species.

As Paul Martin of the Science Policy Research Unit at the University of Sussex points out, companies holding patents are often given a complete monopoly over the development of all therapeutic protein products derived from the gene. “In some cases, the granting of a gene patent to a firm interested in the treatment of one disease has forced others to abandon well-established programmes developing the same protein for other disease indicators.”

Chiron, a California-based biotech company, for example, owns a patent on the screening kit for hepatitis-C, an infectious disease of the liver. The test uses information about the proteins that make up the coating of the virus, proteins that the company’s scientists discovered. The patent claims exclusive rights to the use of that information. So Chiron can determine who can use it and on what terms.

In 1994, the U.S. Supreme Court rejected an appeal against the patent by one of Chiron’s competitors, even though the presiding judge admitted that a patent holder’s rights to restrict competition and raise the price of its products was “contrary to the public interest.” He described this as “the price that has to be accepted” to secure the advantages of the patent system.

In addition, the new E.U. legislation explicitly bars patents on living organisms in their natural state. This means that the products of plant or animal breeding that use

genetic engineering, which involves isolating living material from its natural state, could be patented, but those derived from conventional breeding practices could not. To offer direct incentives to one industry over another is to promote unfair competition.

#### Public Investment

The extraordinary advances in biomedical knowledge over the past 40 years have for the most part not resulted from investment by venture capitalists and pharmaceutical firms. They have resulted from publicly funded education and research, financed with money from the taxpayer or charitable organizations. The public will thus have to pay the price of research twice over if patents are granted on genetic discoveries.

In the United Kingdom, for example, the government in the 1980s and early 1990s played a major role in financing biotech research carried out by universities and other research institutes. The government also provided a significant proportion of the start-up capital for two of the country’s most prominent biotechnology companies. It later sold its interest in one company—Celltech—to a group of private investors.

Furthermore, public financing will have to continue if the biotechnology industry is to survive. “The publicized vigor and successes of biotech companies may foster illusions that basic research can be left to industry,” Kornberg says. In the United States, “more than 90 percent of such research has, in the past, and must be, in the future, done in university and other academic settings, requiring massive support to the tune of billions of dollars from the taxpayer through the federal government.”<sup>9</sup>

In addition to benefiting from taxpayers’ money, the biotech industry has also profited from the goodwill and co-operation of the public. Two of the genes for inherited breast cancer, for example, which have been patented in the United States by Myriad Genetics, were found only with the help of physicians and researchers working with other organizations, not to mention the numerous families with hereditary breast cancer who took part in a worldwide research program that was largely publicly funded.

Wendy Watson, founder of the Hereditary Breast Cancer Foundation and one of several women who have had a preventative mastectomy, has said, “Nobody has the right to patent this kind of information, which was only found with the help of the many families who have suffered a case of hereditary cancer. It is morally wrong that any company should benefit from that kind of information.”<sup>10</sup>

Other genetically inherited diseases whose discovery rested on publicly funded research include polycystic kidney disease and Huntington’s chorea. To patent the genes that are linked to these diseases, and to thereby control the therapeutic use of the information gained, could likewise lead to private profits from knowledge originally gathered for the public good.

#### Access to Treatment

No one is suggesting that companies should ignore the marketplace or forgo profits. But what’s good for business may not always be good for cancer patients, the disabled, or the poor. Indeed, an increasing number of patient groups in Britain, such as Disabled Against Animal Research and Exploitation (DAARE), are concerned about the implications of pat-

ents on genes for medical treatment for those on low incomes.

DAARE, which represents people with serious and incurable conditions that may have genetic links such as motor neuron disease and Parkinson's disease, states that allowing patents on genes will increase health costs and place the fruits of public research into private hands to benefit the few.

Similar concerns have been expressed over the implications of patenting for breast cancer screening. The U.S. company Myriad Genetics has applied for a European patent on the breast cancer gene BRCA-1, as well as on all therapeutic and diagnostic applications resulting from the knowledge of the gene. It currently costs the British National Health Service the equivalent of \$US960 to screen for the two breast cancer genes that have been discovered, BRCA-1 and -2, and around \$US 50 for each subsequent test.

If the European patent is granted, Myriad Genetics will be able to charge whatever it likes every time a diagnostic screening test is carried out. The British National Health Service would be unable to bear the royalty payments.

And this is for just one gene test. If extra money is not made available to the National Health Service, it would have to ration or charge for many services that were previously free. Private health insurers are also likely to have to raise their costs. Many patients will simply be unable to pay, exacerbating inequalities in health care.

Indeed, the Regional Genetic Service of Central Manchester Healthcare NHS Trust warned in 1997 that patenting genes could make

the possibility of genetic testing for disorders such as heart disease or breast cancer so prohibi-

tively expensive it would be beyond the scope of the NHS. While new techniques will soon allow rapid and inexpensive analysis of genes, if a royalty has to be paid on each gene analyzed, testing for breast cancer predisposition—which could involve 10-15 different genes—would be too expensive.<sup>11</sup>

#### Job Insecurity

Proponents of the European life patent legislation maintain that Europe's biotechnology companies will flee to the United States, where the industry is afforded a greater degree of patent protection, at the cost of European jobs and profits.

But more than half the U.K. biotechnology companies interviewed for a 1994 survey published by Arthur Andersen and the Bio-Industry Association said they preferred the British patenting system to the U.S. system, which they viewed as more costly, more time-consuming, and more complex.

Critically, less than 40 per cent of companies regarded secure intellectual property rights—for example, through patents on genes—as important to their competitive advantage. And more than half said that existing U.K. patent law offered them adequate security of intellectual property rights and sufficient competitive advantage.

In fact, the European biotechnology sector is growing now even without explicit patent protection. Between 1996 and 1997, expenditure on biotechnology research and development in Europe went up 20 percent, without explicit patent protection, compared with 3 percent in the United States.<sup>12</sup>

U.S.-based companies with biotech interests have lobbied the hardest for Europe to adopt patent protection. If Europe adopted

patent legislation similar to that in the United States, such companies would be able to charge European companies, hospitals, and research labs for using the genes and DNA sequences they have patented under U.S. law. At present, European companies do not have to pay U.S. patent royalties and licence fees on genes patented in the United States. Patenting is about securing markets, in this instance, the European market. Indeed, since 1990, U.S. companies have filed three times as many European patents as E.U. companies.

The competitiveness of E.U. biotechnology companies will depend on the profitability of their products, not just on legal patents. DuPont's experience with its patented oncomouse—the mouse genetically engineered to be predisposed to cancer—illustrates that patents do not equal profits nor, in the long term, jobs. By 1993, the chemical giant had not persuaded a single pharmaceutical company to buy a licence to use the mouse—it was too expensive.

Certainly, E.U. pharmaceutical companies have been buying up or investing in U.S. biotechnology companies in recent years. But this trend is due far less to a lack of patent protection in Europe than to the fact that the patents held by many of these companies on their existing, non-genetically engineered drugs expire within the next few years. The companies need new products and new markets.

Consequently, both E.U. and U.S. pharmaceutical companies, which are in a similar position, have been globetrotting in search of small biotech laboratories with products and expertise but no money to finance their further development. The *Economist* spelled out the rationale behind biotech mergers in May 1995:

Never was a romance more obviously made in heaven. On one side there stands a string of destitute young biotechnology firms, abandoned by their previous lovers on Wall Street just as their spiffing new products are about to enter the costliest phase of clinical trials. On the other is a group of pharmaceutical giants, all desperate for new R & D ideas as the patents on their existing drugs expire and—by biotechnology standards—with cash to burn. No wonder there has been a certain amount of hopping in and out of bed.<sup>13</sup>

This need for new products, more than anything, explains the pharmaceuticals' rush to buy up or fund biotech laboratories and to secure monopoly marketing rights to the fruits of their—often publicly funded—research through patents on genes.

A 1997 survey of UK biotechnology companies, conducted by management consultants Arthur Andersen, predicted,

Over the next three years, U.S. [biopharmaceutical] alliances [with U.K. companies] are expected to take a clear lead. This reflects both the size of the U.S. market and the market position and power of the pharmaceutical companies. In addition, many observers believe the domestic U.S. bio-partnering market is now close to saturation and that U.S. companies may therefore turn increasingly to Europe to acquire promising technology.<sup>14</sup>

In addition, many companies in the United States have to spend, or at least reserve, a substantial part of their monies to defend any legal challenge to a patent they have been granted or to mount such challenges themselves.

For example, one of the leading U.S. biotechnological companies, Genentech, has four times as many lawsuits to protect its patents as it has products.<sup>15</sup> At least one company has been created in the United States whose main business, according to the *Wall Street Journal*, "is buying up broad patents and then suing other companies for alleged infringements."<sup>16</sup> U.S. biochemist Arthur Kornberg concludes of the U.S. situation: "Patent litigation in industry and academia and the new patent consciousness in academic circles have become serious and highly counterproductive preoccupations."<sup>17</sup>

#### Increased Scrutiny

The overwhelming share of money that sits in the treasure chests of global biotech companies has been put there from public funds. Research grants, government sponsorship, university funding, charitable donations and even payments from public health and agricultural services for patented products themselves are the rich public source of what has become private bounty.

Some regulation of intellectual property rights as they relate to biotechnological products is certainly needed. Such regulation, however, should be preceded by independent substantive assessments of the environmental, social, and economic impacts of genetic engineering, accompanied by wide-ranging, informed public debate and scrutiny of the developments in biotechnology, including patenting.

For these many reasons, the UK Working Group on Legislation for Collective Knowledge and Biodiversity—a coalition of scientists, parliamentarians and concerned citizens—is proposing that the European Union should evolve a framework for legislation that ex-

PLICITLY excludes specified processes and products from patentability, in particular those involving living material. This would represent a sharp departure from its current approach of explicitly including life forms as patentable entities.

The European Union should also:

- Encourage innovation in the biological sciences for the benefit of the public good and the environment;
- Establish a boundary between public and collective interests in society and the private sector, particularly insofar as intellectual property is concerned, so that the public good is enhanced, not undermined;
- Opt for the precautionary principle in assessing the risks of biotechnology and establish strict liability guidelines;
- Establish mechanisms to allow patents to be challenged before, rather than after, they are granted, particularly on the grounds of protecting the public good and preventing violations of collective rights;
- Recognize and protect collective knowledge processes as part of the collective domain of humanity; and
- Establish a system for monitoring scientific advancement for the public good.

The push for patents on genes is not altruistic. It is not about encouraging scientific endeavor or pushing the frontiers of medical knowledge. It is not about feeding the world or promoting the health and well-being of all. It is about ring-fencing knowledge. It is about privatizing the very basis of life. Biotech patenting has little to do with the public good and much to do with private greed. ■

*Nicholas Hildyard and Sarah Sexton work with the Corner House, a U.K.-based research and solidarity group that produces regular briefing*

NOTES

1. Depending on the country granting the patent, a patent gives monopoly rights for 17 or 20 years to the patent holder to use an invention for commercial gain. To be patentable, an invention—a product or a process—must meet three criteria: it must be novel, involve a nonobvious inventive step; and have a commercial application. A patent holder has the right to charge others a license fee for use of the patented product or process and to extract a royalty on any commercial applications derived from it.

2. H. Dalton et al, "Patent threat to research," *Nature*, 385 (February 20, 1997).

3. The main industrial sectors currently exploring commercial uses of biotechnology are pharmaceuticals, food and agriculture,

chemicals, diagnostics and instrumentation, and environmental clean up.

4. Letter from Gareth Evans and others, Regional Genetic Service, Central Manchester Healthcare NHS Trust to all members of the European Parliament (July 1, 1977).

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16. Cited in Fowler, "Biotechnology, Patents and the Third World."

17. Kornberg, *The Golden Helix*, p.233.

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# Whistling in the Wind

*Patents on genetic research are a reality.  
It's time to reframe the debate.*

BY TIMOTHY A. CAULFIELD AND E. RICHARD GOLD

**N**ewspapers and popular magazines alike seem to fall over themselves labeling the 21st century as the biotech century. Media pundits point to the great benefits in health care and agriculture that await us. But they also point to major concerns, such as the private ownership of life. In this, they are aided by commentators such as the futurist Jeremy Rifkin, who argues that the

debate over life patents is one of the most important issues ever to face the human family. Life patents strike at the core of our beliefs about the very nature of life and whether it is to be conceived of as having intrinsic or mere utility value.<sup>1</sup>

A casual observer could not be blamed for thinking that patenting

human genetic material is still an open question. But that casual observer would be wrong. Patent offices in the United States, Europe, Japan, and Canada routinely grant patents on this material—and they have done so for quite a few years. But the mere existence of human genetic patents does not mean that the debate is over; it has simply shifted focus.

The reality is that patent law has overtaken and reframed the debate over patenting human genetic material. Despite strong national and international policy initiatives addressing the patenting of human DNA, the economic drive of the biotechnology industry has made these initiatives obsolete almost as soon as they were taken.

#### \$64 Question

The old, big question that continues to be debated is whether any-

one should be allowed to patent human genes. But the question is largely irrelevant, considering the widespread granting of such patents.

The commercialization of human genetics has become closely linked to intellectual property protection. Biotechnology and pharmaceutical companies, venture capitalists, and even universities view the grant of a patent as an important first step in the commercialization process. An executive with the pharmaceutical giant Merck and Co., for example, believes that

the availability of intellectual property protection for genomic inventions will promote the advancement of biomedical research and the development of new gene-based or gene-derived therapeutics and diagnostics.<sup>2</sup>

While there is strong industry support for patent protection, many others, including researchers and some ethicists, have expressed concern over the commercialization of human genetic material. Critics believe that allowing patents on human genetic material amounts to an affront to human dignity that will further commodify the human experience. Groups such as the Council for Responsible Genetics, for example, have suggested that the “commercialization and expropriation of these life materials is a violation of the sanctity of human, animal, and plant life.”<sup>3</sup>

Many national and international bodies have likewise expressed concern over the commodification of life. For example, in 1997, UNESCO, in its Universal Declaration on the Human Genome and Human Rights, declared that the “human genome in its natural state shall not give rise to financial gains.” Similarly, a Working Group

for the European Commission on the Ethical, Social and Legal Aspects of Human Genome Analysis suggested in 1991 that “the Human Genome or any part of it as such, should not be patentable....” French legislation explicitly provides that the “human body and its elements and products, as well as knowledge of the total or partial structure of a human gene, may not, as such, be subject to a patent.”<sup>4</sup>

Despite these policy statements, patent law has continued to evolve unabated. In fact, researchers and biotechnology companies can patent human genes in the United States, Europe, Japan, Canada, and elsewhere around the world. This is because many courts and patent offices consider that isolated human genes—that is, genetic material extracted and modified or concentrated in the laboratory—meet the requirements of novelty, inventiveness, and utility required by patent law and international treaties. Briefly, *novelty* means the invention has not been described before, *inventiveness* means there is some element of creativeness, and *utility* means it has some commercial potential.

From 1981 to 1995 over 1,175 patents were granted worldwide on human genetic material. In 1995 alone over 652 patent applications involving human DNA were published.<sup>5</sup> Given the vigor of the biotechnology industry, the rate of patenting in this area will likely continue at a robust pace.

#### Stilled Voices

Why hasn't the public debate had a more direct impact on the actual application of patent law to human genetic material? To be sure, industry has been a forceful advocate of genetic patents. But why haven't the counter-arguments of a number of

outspoken and influential stakeholders played a more significant role in the development of patent policy? With few exceptions, the often strong opposition to patents on human genes has had almost no practical effect. There are four reasons for this.

First, in most countries, intellectual property law is simply not structured to handle social policy considerations. In the United States and Canada, for instance, the patent office has no explicit authority to reject a patent on the grounds that it may be deemed contrary to morality. Patent law is meant to be a morally neutral instrument of innovation. It is for the open market to decide which inventions are worthy and which are not—or so patent theory goes.<sup>6</sup> This means that many of the broad social concerns associated with patenting are not even brought to the table in the evaluation of a patent application. For example, the public outcry against patenting higher life forms—such as a genetically modified pig or mouse—has no practical place under current North American patent law.

The European Patent Convention does, however, provide that “inventions shall be considered unpatentable where their commercial exploitation would be contrary to ‘ordre public’ (public welfare) or morality.”<sup>7</sup> While this provision at least allows the introduction of policy considerations, for most biotechnology patents it has done nothing to block the patenting of human genetic material. Even the European Directive on the Legal Protection of Biotechnological Inventions, which recognizes that certain biotechnological inventions should be held unpatentable because of ethical concerns, explicitly recognizes that human genetic material

is normally patentable.

Second, U.S. patent policy has had a profound impact on the international approach to the patenting of human genes.<sup>8</sup> For someone trying to profit from a genetic patent, a U.S. patent is essential. Not only does the United States represent a huge market for genetic inventions, but much of the available venture capital necessary for the development of small biotech companies is found in the United States. However, the United States is also the jurisdiction where the permissive approach to biotechnology patents originated and flourished. In fact, since the seminal U.S. Supreme Court decision *Diamond v. Chakrabarty* in 1980 allowed a patent on an oil-eating bacterium, the “vagaries of the U.S. patent office have led to a broadening of traditional patenting criteria.”<sup>9</sup>

Currently, through the lens of U.S. patent law, there seems very little that could not be viewed as patentable subject matter, so long as the invention has an element of human ingenuity. Taking human genetic material out of its natural state, or purifying it through human intervention, is sufficient to categorize it as a novel invention. This is the rationale that has historically been used to justify the patenting of chemical compounds and that is now used to justify the patenting of purified human genes. This permissive philosophy has led some critics to suggest that the U.S. approach to patenting is to treat “the human genome, the innermost essence of humanity, [as] just another resource for commercial exploitation.”<sup>10</sup>

But U.S. patent law has effects far beyond its borders. Although most countries are not technically required to comply with U.S. patent law at present, many fear trade re-

tialiation from the United States should their domestic patent law not offer the same level of protection to industry as that given in the United States. In addition, countries may be concerned that if they do not follow the U.S. lead, their biotechnology industry will suffer or simply move away.

Third, most industrialized countries view biotechnology—an industry fueled by rapid developments in molecular genetics—as an increasingly important segment of the overall economy.<sup>11</sup> Thus, governments often make it a priority to encourage the patenting of biotechnology innovations. Provincial governments in Canada, for example, have established funds to assist university researchers with the “high cost of intellectual property protection of innovative technology.”<sup>12</sup> Indeed, because of a widely held belief that patents are an important force for innovation, and the fear that private industry will not invest in research unless the information is protected, public institutions like universities, research institutes, and charities are joining the race to patent human DNA almost as fast as the private sector.<sup>13</sup> So, while national governments and international entities caution against patenting human genetic material, economic forces silently dominate the actual development and application of patent law.

The game is not even a fair one. Patent offices can simply ignore the argument, right or wrong, that human genetic patents pose a threat to human dignity. Or they can interpret cautionary policies so narrowly that they become almost meaningless. For example, it is easy to infer that the UNESCO Declaration applies only to nonpurified genes in their natural state—something that was never considered pat-

entable in the first place. In the end, in this pro-industry environment, any policy that might impede economic development will meet with a high degree of resistance.

Finally, even if a country tried to resist the trend toward allowing human genetic patents, it would confront two daunting realities. First, the biotech industry is international. Companies can easily move from one country to another in order to take advantage of favorable regulatory climates. Therefore, efforts by any one country to aggressively enforce ethical standards may well encourage companies to move elsewhere. Second, regulating countries face a set of international conventions relating to patents and international trade. A country wanting to exclude human genetic material from patent protection would be subject to trade sanctions under the World Trade Organization agreements unless it could prove that the sale of that material would violate moral standards.

Given the momentum of the biotech industry and the continued belief that patents are necessary for innovation and economic development, it is highly unlikely any country will change its patent laws to address the emerging ethical concerns. While public debate will undoubtedly continue, patents on human genetic material are here to stay.

#### Code of Silence

The old question of whether human genetic material ought to be patentable has been largely sidestepped by patent law, but there remain many practical policy issues that may help reframe the debate. One major concern is fostering a lively research environment. For example, how can we ensure adequate sharing of information among researchers and regulators and the encouragement

of further scientific advancement when the research is conducted far from the public eye?

A 1997 study found that the pressure to obtain a patent creates an atmosphere of secrecy among researchers. This survey of U.S. life science researchers found “involvement with commercialization and participation in [academic-industry research relationships] are significantly associated with the tendency to withhold the results of their research.”<sup>14</sup> The most often cited reason for the delay in publication was the time it takes to file a patent application, and genetic researchers were found more likely than researchers in other fields to withhold data from others.

It goes without saying that private industry wants full rights to develop and profit from inventions in which it may have substantial investments, and it understandably wants to keep research results secret until it can see a profit on its investment. Moreover, according to the Biotechnology Industry Organization, a trade group representing the interests of biotech companies, industry considers all information about adverse reactions—from unexpected research animal deaths, to mild and severe reactions among human research subjects—to be its exclusive property. And it is not simply an abstract threat of competition that leads industry to this conclusion. Patent law itself requires that inventors keep their inventions secret; otherwise, the invention will be unpatentable. Indeed, if an invention has been previously disclosed, the invention will no longer be novel and thus unpatentable.

This code of secrecy may not only slow the pace of research; it can have implications for patients. Consider the case of 18-year-old Jesse Gelsinger—a research subject in a

gene therapy study at the University of Pennsylvania—who died during the course of the research.

After Gelsinger's death, the *Washington Post* revealed that at least two different research groups in earlier gene therapy studies had failed, despite the obligation to do so, to disclose to U.S. federal regulators the deaths of other gene therapy research subjects.

While we can never know for sure whether the Gelsinger study would have gone forward had this information been available, this high-profile case illustrates how important it is to ensure that patent law does not discourage disclosure. One way to accomplish this is to hold the patent holder liable for any failure to disclose in accordance with regulatory requirements, which include compliance with institutional review boards as well as U.S. Food and Drug Administration regulations and certain requirements of federal funding agencies such as the National Institutes of Health. Accountability would add an economic incentive for researchers to comply with disclosure obligations.

#### Free Trade in Ideas

A second concern of many commentators is that human genetic patents will undermine the ability of researchers to advance their science in the future. One of the primary justifications for patents, including patents on biotechnology, is that they facilitate the dissemination of useful innovations. The hope is that the monopoly ownership conferred by patents will encourage investment in extremely expensive biomedical research and will facilitate the commercialization process that pushes genetic innovations from the laboratory to the clinic.

Ironically, however, there is a growing belief that patents on hu-

man genetic material may actually slow the transfer of technology. For example, one recent pilot study found that patents on human genetic material prevented 25 percent of university and commercial labs surveyed from providing genetic tests to their clients, and nearly 50 percent of these labs decided not to develop genetic tests based on patented genetic material.<sup>15</sup> Of even greater concern, patent holders have threatened to file lawsuits against research labs investigating mutations in patented genes if they continued their activities.

One way to encourage dissemination of information is to introduce a mandatory licensing scheme.<sup>16</sup> Under mandatory licensing, anyone, such as researchers or physicians, would have the right to use the patented genetic material provided they paid a predetermined license fee. But mandatory licensing is not without its problems, especially since it is foreign to U.S. patent law and international trade agreements make mandatory licensing difficult to implement in practice.

An alternative to mandatory licensing is limiting the scope of patent rights in human genetic material. To see how we could do this, we need to understand the mechanics of genetic patenting. Patents are something like gold claims. The bigger the area covered by the gold claim, the greater the value of that claim. If we were to try to stake out a gold claim today in an area that has long been known to have gold, we would likely get only a small claim since all the neighboring land would have already been staked out. If, however, we staked out land that was unknown to contain gold, we would likely get a large claim simply because the land was free from claims.

In an area such as mousetraps,

new patents tend to be fairly narrow. But in an area where few patents have historically been awarded, patents tend to be broad in scope. Genetic patents work the same way. They are fairly new, having taken off only in the last few years. Thus, while there is much activity in genetic research, we are still in the early stages of patenting. This means that human genetic patents tend to be very broad in scope—so broad that some have called them overreaching.<sup>17</sup> For example, some early gene patent applications tried to stake a claim on huge portions of the human genome, even though the exact function of the gene remained unknown.

We can also limit the scope of human genetic patents by reducing the power of the patent holder to exclude others from making beneficial uses of the patent. For example, we can specify that the patent holder cannot prevent others from using the patented invention in research either aimed at discovering new genetic secrets or directed at finding other gene-based therapies. This would allow researchers to build on the rapidly growing collective body of knowledge in the field of genetics.

Another way to limit the impact of gene patenting is to exclude certain discoveries from the patent system. For example, discoveries of bare genes, which have an unknown function, or parts of genes could be excluded from patentability.<sup>18</sup> This can be accomplished by passing federal legislation to that effect, or patent offices and courts could apply more stringent standards of novelty and inventiveness in a more stringent manner.

Patenting of human genes, which remains a big social issue, is probably legally unassailable since to prohibit such patents would go

against the weight of existing intellectual property policy and patent jurisprudence. However, many other ethical issues linked to gene patenting call for further discussion. Patent law sets up many constructive economic incentives for the biotech industry; however, some of these also have negative ethical results. While outside regulation can undoubtedly alleviate many concerns, a countervailing economic incentive built into patent law could help to mitigate the rest. As we enter the biotech century, we need to think of innovative ways of subtly changing patent law in order to move toward an intellectual property policy that is beneficial to all—industry, researchers, patients, and the public. ■

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# Country Classrooms

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## The Challenge Ahead for Rural Schools

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# Reading, 'Riting, and Rural Development

**C**oncerns about how to encourage rural development in this country date back at least to the beginning of the past century when President Theodore Roosevelt appointed his Country Life Commission. “The social and economic institutions of the open country are not keeping pace with the development of the nation as a whole,” Roosevelt warned. That these words ring true 100 years later shows how intractable the problem is. Enter rural schools.

The role of education in rural development has long been a subject of debate. Like other rural institutions, schools face a two-edged sword. Their rural locale often presents obstacles—financial hardship, teacher shortages, and few advanced-course offerings. And yet, smallness and relative isolation can translate into a quieter, safer, and more nurturing learning environment.

Still rural schools are not as handicapped as conventional wisdom supposes. Robert Gibbs from the U.S. Department of Agriculture says rural students, for the most part, score as well on standardized tests and graduate from high school at the same rates as their urban counterparts.

In spite of that parity, however, rural students are still less likely to

attend college. Reasons vary from a lack of local jobs that require higher education to a lack of advanced courses that prepare them for college. Whatever the cause, the results are damaging to rural students—college graduates earn on average 76 percent more than those with only a high school diploma.

Technology can help prepare rural students for college. In fact, distance learning—the opportunity for rural students to learn at their own pace through telecommunications and the Internet—is changing the way rural schools function. Southern Utah University’s Bruce Barker chronicles the many advantages of distance learning and provides a list of educational resources found on the World Wide Web.

In spite of the advantages of distance learning, however, few believe the Internet can obliterate all obstacles. Indeed, one of the largest obstacles is getting connected in the first place. Additional assistance is often needed and, according to Robert Stephens of the Institute for Regional and Rural Studies in Education, is available in the form of education services agencies. Since the 1960s, these agencies have been helping schools with staff and curriculum development, disabled student assis-

tance, and, of course, technology.

Much of the recent impetus to improve rural schools has been to improve the economic prospects of students and, by extension, their hometowns. Hobart Harmon at AEL Inc. and Stuart Rosenfeld and Cynthia Liston of Regional Technology Strategies Inc. look at the connections between education, employment, and rural development from different perspectives—Harmon focusing on the school-to-work transition, Rosenfeld and Liston on the role of community colleges.

Lest we should think that the goal of education is to help students find good jobs, however, Paul Theobald and Jim Curtiss of Wayne State College remind us that such a goal is a far cry from the schools’ original purpose. When public schools were first established, the goal was to provide students with a broad education. Schooling, the authors note, “was about improving life, not by enabling individual acquisition in the marketplace, but by setting up better deliberation in the policy arena.”

It’s a point worth pondering as we continue to grapple with ways to promote rural development in the 21st century.

*The Editors*



# The Challenge Ahead for Rural Schools

*America's rural schools are performing as well as their urban counterparts, but much remains to be done if we hope to make our rural education system one of the best in the world.*

BY ROBERT GIBBS

**A**rural renaissance in the 1990s has refocused attention on schools and other institutions that shape economic and social outcomes. Perceptions of rural schools and the quality of rural education have moved away from the condescension of an earlier era. Where rural schools were once viewed as out of touch with modern society, suffering from geographic isolation and the inefficiencies of small enrollments and lack of specialization, they are often now praised for some of those same attributes. Mounting statistical and anecdotal evidence of the benefits of small school size and close ties with the local community have led to favorable comparisons of rural schools with their often oversized urban counterparts.

Until recently, the lack of data limited our ability to assess the performance of rural schools and their long-term impacts on students and communities. That has changed. We are now better able to describe general trends in the quality of rural education and identify specific strengths and weaknesses in the entire range of educational institutions and processes that make

up the rural education system.

The picture that emerges from the most recent research is that rural schools are generally performing as well as urban schools. A key measure of performance—standardized test scores—demonstrates that rural students in the 1990s can easily hold their own.

But weaknesses remain—partly the inevitable downside of small size

and lack of specialization and partly a manifestation of the socioeconomic milieus that distinguish many rural areas from urban areas. For example, compared with urban youth, rural youth are less likely to be academically prepared for and attend college. Thus, rural schools are competitive at grooming workers for jobs in the lower and middle ranges of the skill distribution but have still not caught up with urban, and particularly suburban, school districts in preparing students for advanced education.

The past decade has emerged as a critical moment for many rural labor markets. Computer use in the workplace has accelerated, and rural firms appear to be adopting high-tech production and management methods at about the same rate as urban firms. Rural labor markets are also becoming more like

urban ones in the education requirements for local jobs. A key challenge for the rural education system, then, is to preserve its competitive advantages—small scale and close community ties—while it better prepares its students for the higher skill jobs that are coming to rural America.

#### Rural Readiness

**A** recent assessment of the rural education and training system conducted by federal and university researchers examined rural workforce preparation and readiness, comparing it against urban conditions and the changing needs of rural employers. The following discussion is based on the findings of that report.<sup>1</sup>

According to the report, rural schools overall score nearly as well as urban schools in a variety of areas, though rural schools occasionally have fewer financial resources. Convergence in standardized test scores—based on a comparison of the performances of rural and urban 17-year-olds in reading, mathematics, and science using the National Assessment of Educational Progress—is an excellent indicator that rural schools have caught up.<sup>2</sup> Since the 1970s, the NAEP has been administered to students at various age levels. It is a rich source of information for education research because it links test scores with information on students and schools, including location.

In 1994, the latest year analyzed in the report, there was no statistical difference nationwide in the test scores of rural and urban students in math or reading, while rural students led slightly in the science component. This represents a rise in rural scores and a resulting convergence with urban scores since 1975,

when rural scores were slightly below urban scores in science and reading and were significantly lower in math.

The reasons for convergence are only partly understood. In their demographic and economic attributes, rural students have become more similar to their urban counterparts, as have the rural communities that support local school systems. And too, federal and state

Lower pay for experienced teachers in rural schools may play a role in rural teacher quality, which lags by some measures. Teachers in rural schools, for example, are younger on average and have less experience. Compensating factors that can allow rural schools to retain teachers at age 25 or 30 are less effective for 45-year-olds in the face of large urban-rural salary differences or opportunities in better-paying professions.

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### **Federal and state governments in the last few**

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### **decades have committed to equal financial support**

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### **for rural and urban schools.**

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governments in the last few decades have committed to equal financial support for rural and urban schools.

Higher rural student achievement is also due to improvements in rural schools themselves.<sup>3</sup> In fact, the report finds little evidence to support the lingering images of outmoded organizational structures and inadequate curricula.

Nevertheless, some gaps remain. For example, differences in teachers' salaries and qualifications persist. Urban salaries are about 21 percent higher for starting teachers, and 35 percent higher for teachers with masters' degrees and 20 or more years of experience. Since experience is typically rewarded more in urban labor markets than in rural markets, the increasing salary disparity with age is unsurprising. What may surprise some is that rural teachers express as much satisfaction with their pay as urban teachers, which may reflect compensating factors, such as greater autonomy and influence, which rural schools offer.

About a third of rural teachers have graduate degrees, while nearly half of urban teachers do. Furthermore, rural teachers are only about half as likely to have graduated from top-ranked colleges or universities. This last fact is troubling, given the established links between the quality of a teacher's education and his or her classroom performance. A closer inspection, however, shows that this statistic applies to a small share of teachers—7 percent of rural teachers and 15 percent of urban ones graduated from more-selective colleges.

These differences seem less important when weighed against the positive news coming out of rural schools. Rural teachers are often more satisfied with their work environments and are more active in their local communities. Both of these traits improve a teacher's ability to motivate and relate to students and to feel invested in their school's performance. Due in part to smaller school size—which is typically about half that of a large central-

city school—rural teachers also have a greater degree of autonomy and more direct influence over school policy than do urban teachers. Finally, rural students may well benefit directly both from smaller average school size and lower student-teacher ratios, although the latter remains a source of continuing debate.

school graduation and college attendance.

The distinctive demographic and economic composition of the region is a decisive factor in the region's educational attainment record. When attainment rates are analyzed by race, we find that blacks enter and graduate from college at much lower rates than whites. Indeed,

## College Bound

Parity in rural and urban test scores in recent years has gone hand in hand with convergence in the number of years spent in school. Compared with similar urban residents, for example, young rural adults are about as likely to have graduated from high school. Still, a significant deficit remains even among this age group: a higher percentage of urban youth obtain some college education.<sup>6</sup> Since rural students who attend college are as likely to graduate as urban attendees, the gap in college attendance is the main component of rural-urban educational differences among younger adults. In fact, in a major longitudinal survey of adults currently in their 30s and early 40s, 65 percent of urban high school graduates attended college, compared with only 56 percent of rural graduates.<sup>7</sup>

Why does the urban-rural gap persist at this critical point in the education process? Rural students, on average, possess fewer of the characteristics that encourage college attendance. Consider, for example, how family traits affect the likelihood of attendance. On average, rural families have lower incomes and less wealth than urban families. Consequently, rural families are less able to afford college, although they may compensate by sending their children to less expensive, and often less prestigious, public colleges. The parents of rural students are also less likely to have a college education themselves—another well-established predictor of college attendance.

Community factors are important as well. Local social and economic conditions affect young people's perceptions of the value of a college degree, expectations about

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## The South's continuing job growth and rising

## incomes are the ever-essential economic engine

## that will propel further improvements.

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### Southern Challenges

These findings apply to the average, and probably to the majority of, rural schools and rural students. When we look at the findings on a regional basis, however, educational outcomes in the rural South are worse. Nearly all of the studies cited found that southern rural schools fell below average on a wide range of quality measures.

For example, one of the strengths of rural schools overall is the high marks that teachers give their work environment. Yet, this is exactly where southern rural teachers appear to differ. Their pay is low, even for rural schools. And more importantly, they report less satisfaction with many dimensions of their environment: salaries, resource availability, class size, teaching as a career, and the level of problems in the learning environment.<sup>4</sup>

As for performance, rural southern test scores fall well below the levels of other regions. Rural southern educational attainment is lower, too, including lower rates of high

college attendance rates for white southern high school graduates are as high as for other rural whites. The same is not true for rural, mostly southern, blacks, who are less likely to attend college than urban blacks.

Thus, the South's educational disadvantages can best be understood in the context of the region's historically biracial society. The presence of a significant black minority—and in some counties a majority—complicates the portrait of a southern lag because many measures used to describe rural education break along racial lines.

Even here, though, there is good news. NAEP scores for blacks have risen faster than for whites since the 1970s, suggesting that efforts to provide all students with a decent education have been at least partially rewarded.<sup>5</sup> And for both blacks and whites, as well as for the region's growing Hispanic population, the South's continuing job growth and rising incomes are the ever-essential economic engine that will propel further improvements.

their work life, and the decisions they make about education. A local economy with few high-education jobs offers few role models and little exposure to high-skill occupations. Eighty percent of rural residents live in counties where less than 15 percent of the adult population has a bachelor's degree; this is true for only 21 percent of urban residents.

The wage structure of many rural labor markets may also dissuade some youth from attending college. Since the monetary returns to a college degree are typically much lower in rural labor markets, rural students may underestimate the benefits of a college education and choose immediate employment instead. And even though the labor market for rural youths theoretically extends beyond their local boundaries, information about local conditions is much easier to obtain and therefore exerts a large influence.

Similarly, roughly half of rural high school students live in counties that have no colleges, compared with a tenth of all urban students. Consequently, the average rural teenager is less familiar with the social and cultural enrichment and the encouragement to continue in education that a college and its faculty bring to the community.<sup>8</sup>

But if family, community, and the local economy are primary influences on an individual's college decision, what role is left for rural schools to play? The answer may lie in increased college preparatory programs.

Rural schools offer fewer advanced and college preparatory courses than do urban schools. In urban areas, for instance, 93 percent of graduating seniors will have taken calculus. Only 64 percent of rural seniors will have done so. The urban-rural gap for physics is 64 percent to 34 percent.<sup>9</sup>

The lack of college-prep courses makes it harder for rural students to qualify for advanced placement in college and may affect their performance on other standardized entry tests. The relationship between college attendance and courses offered in high school is not likely to be a simple cause-and-effect relationship, however. Moreover, there may be less demand—or at least

expand traditional career pathways—for example, by providing the better students with information about more selective colleges and universities in other parts of the country.

Still, the Internet and other new technologies are only as effective as the quality of the information transmitted. If the new computer-based tools are used merely to transmit the

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## **The new information technologies can help**

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### **prepare rural students for rigorous post-secondary**

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### **education where local resources are limited.**

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perceived demand—for prep courses in many rural school districts, as well as a lack of teachers qualified to teach advanced classes.

One of the remaining challenges of the rural education system, then, is to provide the same channels for advanced educational opportunities as are available elsewhere in the nation.

Although the studies discussed here do not explicitly describe ways to overcome the disadvantages to a rural location, their findings taken together suggest a number of options—most importantly, the use of computer-based technologies that can break down rural barriers.

The new information technologies can help prepare rural students for rigorous post-secondary education where local resources are limited. Schools must provide access to the technologies, a task made easier due to increasing support from state and federal assistance programs. It is crucial that schools also guide students to and through information about post-secondary education and work opportunities in ways that

same information as before, only more efficiently, rural students will be ill-served. If, however, information about distant opportunities broadens rural students' ideas about education and work, and focuses and sharpens their strategies for meeting new goals, real change in educational and, ultimately, labor-market outcomes will occur.

#### Changing Labor Markets

**S**olutions to persistent problems in the rural education system, of course, will come not from schools alone, but also from the local economy. Places that can attract highly educated residents who have a social and economic stake in the quality of the local school system can garner not only the community capital that leads to school improvements, but also the interpersonal and institutional ties that reinforce the desire for education among youth.

Rural labor markets in the 1990s are probably as encouraging to educational investments as any in this century. In general, rural economies

grew briskly after the 1990-91 recession and even outpaced urban areas in the first few years of expansion. Hundreds of rural counties that had lost population and employment in the previous decade saw growth, or at least a notable slowing of the decline. At the same time, college degrees became increasingly attractive as the wage gap between the most and least educated rural

and the ability of workers to apply those skills in a computer-based environment.

The evidence suggests that rural schools are, for the moment, up to the task. Although functional illiteracy is a problem for many older employed rural adults—nearly half scored in the low or very-low range on the National Adult Literacy Survey, depending on the type of lit-

as with the requisite technical and analytical skills.<sup>12</sup>

These firms presently constitute a small share of rural manufacturing establishments, but as new methods become more widely adopted, schools will need to change the way they prepare students for the working world. More and more firms will require higher levels of reading and math proficiency, and schools may feel pressured to tighten academic standards—a movement already underway in many parts of the country. And as worker productivity becomes increasingly dependent on facility with the latest computer-based technologies, schools can assist the school-to-work transition by providing access to up-to-date training that meets the needs of local establishments.

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## **Schools can assist the school-to-work transition by providing access to up-to-date training that meets the needs of local establishments.**

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workers widened. Accordingly, the net out-migration from rural areas of college graduates slowed to its lowest rate in 20 years.

Some of the improvement has undoubtedly arisen from the technological innovations of the new information age as new forms of work organization and production technologies have been adopted in rural firms about as quickly as in urban ones, bringing efficiencies and counterbalancing pressures to move production offshore or close shop altogether.

It should be noted, however, that many of these “new economy” organizations and technologies will not require most workers to obtain college degrees. In fact, the largest share of jobs in the rural economy of the near future will require a level of education beyond high school but short of a bachelor’s degree. Thus, while encouraging students to attend college is beneficial both for individuals and the aggregate economy, rural schools should be equally attentive to ensuring proficiency in reading, writing, and math

eracy tested—literacy rates for younger rural workers, ages 25 to 34, are much higher and are similar to younger urban workers.<sup>10</sup> Whatever the shortcomings of rural schools in years past, they now appear to be doing a much better job at teaching literacy skills.

Moreover, employers by and large do not report basic literacy or numeracy as a key rural workforce problem.<sup>11</sup> In a survey of 3,000 rural manufacturers, only 12 percent cited literacy as a problem, and only 5 percent cited numeracy. Indeed, only a third cited the quality of available labor as a major problem. Instead, the lack of good work habits was the most commonly mentioned complaint.

Still, there is no guarantee that current levels of academic preparation among rural high school graduates will be sufficient beyond the very near future. Firms investing heavily in computer-based production methods and work organization often do report trouble finding workers with sufficient proficiency in reading and math, as well

### The Challenge Ahead

**R**ural schools and students have made enormous strides in the last half of the 20th century and deserve a good report card. On many indicators, they compare favorably with their urban and international counterparts.

Even so, there is little room for complacency. Policymakers should take a close look at the entire cycle of educational attainment, labor force development, and reinvestment in the community’s educational infrastructure—or lack of it. Just as the education-labor market link was the tie that hindered advancements in many rural systems, it can also be the mechanism for historical change; as regional and local economies become more alike, so do their education needs. Remedies to remaining problems will need to take into account the requirements of the high-skill workforce development track touted

at all levels of government and the private sector as well as the uneven educational attainments of the rural population.

The challenge ahead is to lift the average to the level of today's best. Success in meeting this challenge would mark one of our finest achievements.■

*Robert M. Gibbs is an economist with the Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D.C.*

#### NOTES

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2. E.J. Greenberg and R. Teixeira, "Educational Achievement in Rural Schools," in Gibbs et al., *Rural Education and Training in the New Economy*.

3. D. Ballou and M. Podgursky, "Rural Teachers and Schools," in Gibbs et al., *Rural Education and Training in the New Economy*.

4. Ibid.

5. Greenberg and Teixeira, "Educational Achievement in Rural Schools."

6. R.M. Gibbs, "College Completion and Return Migration among Rural Youth," in Gibbs et al., *Rural Education and Training in the New Economy*.

7. These findings come from a study of rural students, not rural adults. Because rural economies typically require fewer highly educated workers than do urban economies, many rural students with college degrees migrate to urban areas in search of work. Thus, studies that measure college attainment of adults may understate the propensity of rural

residents to attend college.

8. The comparison understates the urban-rural gap to some extent because it counts as a college any post-secondary institution with an academic program component. Beauty schools, for instance, would not qualify, but most two-year community colleges would. If one considers only institutions offering baccalaureates, the share of rural counties with no such colleges rises to 71 percent, compared to 18 percent of urban counties.

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# Anytime, Anyplace Learning

*As teachers and students turn to the Internet, distance learning is dismantling classroom walls across America.*

BY BRUCE O. BARKER

**F**ew educational innovations in recent years have caught the interest of educational policymakers like distance learning. State-sponsored curriculum reforms, reductions in state fiscal revenues, teacher shortages, and an increased desire to broaden educational opportunities for all students have increased the opportunities for using distance learning to deliver instruction.<sup>1</sup>

## Distance Learning Defined

Distance learning is typically defined as the delivery of live instruction from one site to another, or to multiple sites, using audio or video technologies that allow the teacher and students at different sites to interact with each other. Recent de-

velopments in communications technology are expanding this basic definition. In the past, if distance learning was to be interactive, students and their teachers separated by distance had to meet at the same time via telecommunications. Under ideal conditions, students at any one site were provided direct contact with their instructor, as well as communication with students at other remote sites during the instructional process.

Increasingly, however, programs today do not require that participants meet at the same time. Such programs allow virtually “anytime, anyplace learning.” This is particularly true of courses delivered over the Internet.

Today’s digital revolution and the exponential growth of the Internet

have given rise to a vast number of websites and electronic databases that combine text, audio, graphics, and video information, which can be downloaded and viewed on a personal computer. This allows individuals to gather information, keep current on virtually any topic of interest, and communicate with others across the country or around the world on their own time and at their own pace.

Not surprisingly, time-insensitive distance learning via the Internet is growing much more rapidly as an educational delivery medium than such time-sensitive delivery systems as satellite, fiber optic, cable, or other TV-based networks.<sup>2</sup> In addition, the infrastructure and telecommunications costs of the Internet are less than other distance learning systems.

With the ever-increasing number of Web-based courses, as well as the exponential growth of the Web as an information resource, Bill Rodrigues, vice president and general manager for Dell Computer’s K-12 education business unit, offers a more expanded definition of distance learning:

The best term to describe distance learning is anytime, anywhere learning because that implies that learning is not confined to the four walls of the classroom. Through distance learning, learning can take place from anywhere on campus, from home, through peers around the world, through the Internet, or even from a hospital room. Distance learning means not necessarily having a teacher and students physically in the classroom but learning from anywhere via the use of a computer.<sup>3</sup>

Learning anytime, anywhere is happening today, and will happen

more in the future as access to information and communication improves. There are already a number of online high schools. More important, however, more and more schools across the country are connecting to the Internet, allowing students to learn on their own as well as join other learners in virtual communities linked by technology.

#### Online High

Choice 2000, a public charter school in Riverside, California, presents itself as the first totally online public high school in the United States.<sup>4</sup> The school offers a fully certified 7th-through-12th-grade curriculum, plus adult education programs, online via the Web. The programs are accredited by the Western Association of Schools and Colleges. Tuition, textbooks, and software are free to residents of California, while the basic tuition for out-of-state residents is \$175 per class for a nine-week semester, with additional costs for mailing textbooks and materials, depending on location.

Online attendance requirements are similar to traditional school requirements; students are expected to log-on every school day, Monday through Friday. Classes are held in a live email conference chat-room format with as many as 40 students and a teacher connected at one time. In this format, teachers can present information, hold electronic discussions, or answer student questions online; additionally, teachers and students can communicate regularly via email. Students complete assignments from the teacher, as well as assignments delivered through a computer-based education and communications network that provides self-paced, interactive courses. Although the students do not travel to school to take classes, the school

nonetheless offers extracurricular school activities such as dances, field trips, and picnics to encourage the students to interact socially.

Across the United States, a small but growing number of other online schools have been recently established in addition to Choice 2000.<sup>5</sup> Gifted students often prefer online schools because such schools allow students to progress faster academically than traditional schools might permit. Students with physical or mental disabilities sometimes turn to distance learning to avoid the stigma they fear they might encounter at a more traditional school. Other students prefer distance learning because they are attracted by the computer technology. Students in remote areas often choose distance learning to avoid long bus rides. And increasingly, students and parents alike are turning to distance learning to assuage their fears of violence on campus.

#### The Three Ws

While a number of online high schools have been established, the fact remains that they affect few students. Although additional online schools will surely be established, the likelihood of broad appeal to either students or parents is unlikely.

Of greater interest is the use of the World Wide Web as a distance learning tool to benefit teachers and students in traditional school settings across the entire K-12 curriculum. Providing schools with ubiquitous high-speed access to the Internet is clearly a means to promote inquiry and learning in the classroom and beyond the limitations of textbooks. The promise of rapid access to the World Wide Web empowers teachers and students to access enormous amounts of information and interactive resources.

Internet access enables all students in all classrooms in all schools to become active distance learners. Likewise, teachers can more readily expand learning opportunities for their students. Through access to the vast amount of resources on the Internet, teachers in Web-supported classrooms are able to:

- Take students on electronic field trips,
- Clarify and expand new information learned in the classroom,
- Design lesson plans and enrichment materials in support of local and national learning standards,
- Arrange for students to participate in collaborative projects with students around the world, and
- Expose students to the massive collections of information regularly being added to the Internet.

#### Web Connections

One of the top goals of the U.S. Department of Education was to connect every classroom to the Internet by 2000.<sup>6</sup> Although that goal was not achieved, the number of Internet-connected classrooms has increased sharply in recent years, and essentially all classrooms are expected to have Internet access early within the new millennium.

Worldwide, nearly 200 million people have access to the Internet—with 80 million users in the United States alone. In a recent study published in *Education Week*, researchers found that 51 percent of American classrooms reported having Internet connections in 1998, an increase of 27 percent from the previous year.<sup>7</sup> The same study indicated that 49 percent of the nation's schools have high-speed connection to the Web. Furthermore, the ratio of Internet-connected computers to students was 1 to 13.6 nationwide in 1999, a marked improvement from 1998 when the average ratio

was 1 to 19.7. Ratios vary considerably among the states, with Delaware reporting the best ratio of 1 Web-connected computer to 5.6 students, North Carolina reporting 1 to 25.4, and the District of Columbia reporting the worst ratio of 1 to 31.1.

#### Virtual Learning Communities

The Web is the medium by which Internet resources can be organized for information access and exchange. It is attractive to students and teachers because someone else has already done the work of locating and organizing meaningful collections of Internet resources.<sup>8</sup> Using the Web, teachers and students can more easily form learning communities extending far beyond the classroom. They can free themselves of the bonds of geographical isolation, which can be critical in rural schools.

These virtual communities

emerge in cyberspace whenever a group of learners in different locations carries on public discussions with sufficient human interaction to form learning relationships. Teachers and students in virtual learning communities use words and images on screen to exchange greetings, engage in intellectual discourse, conduct meetings, share knowledge, offer emotional support, make plans, brainstorm ideas, learn about other cultures, and otherwise broaden their mental horizons. In fact, they do much of what teachers and students might do in traditional classrooms, but they do it online and thereby extend the community of the classroom into the community of the world.<sup>9</sup>

#### Internet Strategies

As a teaching and learning tool, the Internet permits interactive, nonlinear navigation through its pages, and it activates the senses of sight,

sound, and cognitive reasoning, engaging students and creating active learners. The Internet allows for a variety of learning strategies. Judi Harris at the University of Texas identifies seven educational activity structures that can be incorporated into Internet teaching strategies:

- Information searches—students are given clues and must use resources, either on or off the Internet, to solve the problem.

- Electronic process writing—students post their written work, such as poems or essays, to a user group for critical feedback.

- Sequential creations—students begin or add to the work of others. An example might be a poem about world peace that “virtually” travels to many locations, with new lines being added at each stop along the way.

- Parallel problem solving—students in several locations work separately on solving the same problem and then electronically share their

### NOTEWORTHY EDUCATIONAL RESOURCES ON THE WEB

- **SURWEB:** <<http://www.surweb.org>>. A multimedia tool for teachers and students, with over 30,000 images.
- **U.S. Department of Education:** <<http://www.ed.gov/>>. The federal government’s education site.
- **The Discovery Channel School:** <<http://school.discovery.com>>. Offers lessons for teachers to use with students on timely topics.
- **The Why Files: The Science Behind the News:** <<http://whyfiles.news.wisc.edu/>>. An online newspaper that explains the science behind the news headlines.
- **The Nine Planets: A Multimedia Tour of Our Solar System:** <<http://seds.lpl.arizona.edu/billa/tnp/>>. A comprehensive examination of our solar system.
- **The Cow’s Eye Dissection:** <[http://www.exploratorium.edu/learning\\_studio/cow\\_eye/](http://www.exploratorium.edu/learning_studio/cow_eye/)>. A step-by-step lesson on the anatomy of a cow’s eye.
- **Fractals:** <<http://math.rice.edu/~lanius/frac/>>. A fractals unit for elementary and middle school math students that is both fun and informative.
- **Candlelight Stories:** <<http://www.CandlelightStories.com>>. A collection of stories from around the world.
- **Shakespeare Headquarters:** <<http://the-tech.mit.edu/Shakespeare.html>>. Complete collection of the comedies, tragedies, sonnets, and poems of William Shakespeare.
- **1492 Exhibit:** <<http://sunsite.unc.edu/expo/1492.exhibit/Intro.html>>. Library of Congress exhibit that follows the 1492 voyage of Christopher Columbus with maps and graphics.
- **Welcome to the Civil War Center:** <<http://www.cwc.lsu.edu>>. More than 1,000 links to information about the bloodiest war in American history.
- **The Invention Dimension:** <<http://web.mit.edu/invent/>>. A site on the people and stories behind inventions.
- **The Louvre:** <<http://www.louvre.fr>>. Perhaps the world’s most famous art museum with works by many of the masters. ■ **BOB**

findings, methods, and analyses.

■ Virtual gatherings—students from different geographic locations gather electronically to discuss a problem or question.

■ Simulations—students access or create virtual worlds that allow them to explore such things as climate-change modeling and plant-growth modeling, or simulate space shuttle launches, historical space missions, space colony design, ozone-layer repair, and stock market investments.

■ Social action projects—students engage in such activities as fund raising, ecology projects, and issues awareness.<sup>10</sup>

#### In Loco Parentis

The Internet is a decentralized conglomeration of networks with no central administrative headquarters or governing body. By design, no one fully monitors or censors information entered to servers interconnected around the world. As a result, students not only can access unlimited information on almost every wholesome topic known to humanity, they can access information on almost every deviant and perverse topic as well. To guard against this, schools can use filters to screen or prevent access to controversial topics. Most schools have adopted appropriate-use policies, which typically stipulate that students shall not intentionally access or download any text file or picture, or engage in any conference, that includes pornography, violence, racism, anarchy, treason, or discrimination.

#### Tomorrow's Technonauts

The Internet is today and tomorrow's tool for communicating with others, irrespective of distance and time. While some skeptics may criticize the computer as a form of depersonalized learning, Internet-

connected computers actually do more to put learners in contact with other learners than any other telecommunications medium available. The Internet promotes the concept of a community of learners, not only in the traditional classroom, but in virtual learning communities linked together by state, national, and global connections.

Once students have full access to the Internet, changes are certain to occur in the teaching and learning process. Under the guidance of skilled teachers, students will become "technonauts." Much like astronauts who explore unknown worlds, technonauts are knowledge explorers who use technology to find, exchange, and analyze information. As technonauts, students will take more responsibility for their own education and will collaborate with others to find information outside the classroom. The more traditional roles of teachers and students will break down—in some cases, students will become teachers while teachers become students.<sup>11</sup> In the classroom, teachers will serve as facilitators, guides, and co-learners.

The Web is the most pervasive and perhaps easiest tool for promoting distance learning in the world today. It can take students beyond the boundaries of the classroom or the confines of the standard school day. Regularly updated websites are much more current and timely than printed textbooks. The opportunity for students and teachers, at the click of a mouse, to explore topics of interest from databases around the world empowers them to grasp a vision of learning beyond anything that was considered possible even a few years ago.

As education moves into the 21st century, students need to develop skills and expertise in accessing, ex-

changing, and analyzing digital information if they hope to be successful in the world and workplace of the future. Without doubt, they need exposure to today's telecommunications tools to master the knowledge and technology that will shape tomorrow's society.

Just as the technology of the printing press revolutionized learning in the 15th century, so the technology of the Internet too, will revolutionize learning in the 21st century. As the Internet evolves and students and teachers become increasingly proficient at navigating its databases and services, the information of the world will truly be at their fingertips—anytime, anyplace.■

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#### NOTES

1. Distance learning in American K-12 classrooms received its legislative impetus when the U.S. Congress passed Public Law 100-297 in late 1988, allocating \$100 million to create the federal Star Schools Program in support of distance learning. The program has served more than 1.6 million students across the nation. These students, however, represent only 3.5 percent of all public elementary and secondary students. Therefore, the overall impact of Star Schools has been minimal at best. For more information on the program, see U.S. Department of Education, *What is the Stars Schools Program?* (Washington, DC: Dept. of Ed., 1996), available at <[www.ed.gov/prog\\_info/StarSchools/whatis.html](http://www.ed.gov/prog_info/StarSchools/whatis.html)>.

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# Partners in Rural Education

*Education services agencies can be the saviors of rural school systems throughout the nation.*

BY E. ROBERT STEPHENS

**T**he nation's education system is undergoing a massive overhaul, and our rural schools, like their urban counterparts, are facing the most comprehensive and daunting improvement agenda in their history. The agenda calls for rigorous content standards, enhanced instructional programs and staff, more parental involvement, improved school governance, increased fiscal resources, program access for special students, and performance accountability for local school districts.

For rural school systems, with their small scale and limited human and fiscal resources, the agenda's challenges are compounded. For example, some state requirements—such as the requirement that schools employ in-house technology experts—are often too costly for an individual rural system to absorb.

In other cases, a program or service may not be warranted in an individual rural school because of limited interest or need. For instance, a rural school having a small number of students with a particular disability may not be able to justify the expense of hiring an education specialist.

If a rural school system is fortunate enough, however, to be in a state that has a network of education services agencies—agencies established by the states to provide a variety of support services to ensure that students get a quality education—the school system's small size and limited resources are less of an issue.<sup>1</sup> Thanks to the economies of scale inherent in education services agency networks, these agencies can provide schools with access to programs, services, and technical assistance that otherwise might be unavailable.

## Core Services

Education services agencies and statewide networks of such agencies function in a number of states. Created either by legislation or administrative fiat, these agencies facilitate local school districts' access to such federal and state programs and services as staff development, curriculum development, technology support, and assistance for disabled students. Not all education services agencies are the same. Some offer special programs for disabled students, gifted students, or adults. Some provide access to health services or social work services, and some offer financial planning, computer support, and printing services.

A majority of education services agencies bring real cost savings to participating rural systems—for instance, cooperative purchasing—and do so with greater quality by pooling the expertise and experiences of multiple school systems. While actual savings are difficult to quantify, studies have reported savings ranging from several thousand dollars for each local system in one state to over \$100 million for all schools in another.<sup>2</sup>

While service to a specific class of local districts—for example, urban, suburban, or rural—is rarely part of these agencies' official mission statements, it seems clear that one of the primary reasons states support them is to aid rural districts and to increase the efficiency, effectiveness, and quality in the programming of the many small school systems located in rural areas.<sup>3</sup>

## Historic Roots

Many state networks have been in existence for over three decades. A number of developments converged in the 1960s and 1970s to spur formation of these early networks. Two warrant special mention.

First, rural interests presented widespread and frequently well-organized opposition to mandated school district reorganization—the dominant strategy for addressing the problems of rural schools from the mid-1940s to the early 1970s. While there is no disputing the early success of forced district reorganization, policymakers viewed the creation of state networks of education services agencies as a viable, and less contentious, alternative.<sup>4</sup>

Second, Congress passed the first Elementary and Secondary Education Act in 1965. Title III of the act provided federal funds to states to promote a regional structure for the delivery of media and instructional services to school districts. Many states chose to use the Title III incentive and subsequent federal incentives that promoted collaboration among school districts to reex-

amine the viability of county offices of education. These offices had been created earlier to perform administrative functions for the large number of one-room and very small schools that were still found in rural areas 50 years ago. Federal funds served to expedite the restructuring of single-county offices into a newer, multicounty, service-oriented agency.

#### Evaluating ESAs

While data on the effectiveness of education services agencies are limited, two recent statewide studies suggest that state networks offer quality programs.

In Iowa, 6,000 superintendents, teachers, and other education personnel were asked to evaluate the state's 15 "area education agencies."<sup>5</sup> About 70 percent of Iowa's 300 local districts are rural. The

evaluation considered such topics as responsiveness to needs, reliability of services, timeliness of services, accessibility of services, currency of programs, adequate communications, staff knowledge and expertise, and overall merits. In the study, all categories except timeliness were ranked "good to excellent."

When asked how much they depend on area education agency services, nearly a third of those responding indicated they were "absolutely dependent," and nearly a half indicated they were "often dependent." Only 2 percent responded that they did not need the area education agencies.<sup>6</sup>

Similar results were obtained in a 1996 survey of Texas school districts focusing on the state's 20 "education service centers."<sup>7</sup> Some 85 percent of school administrators indicated that their districts make

## ESA SERVICES

**E**ducation services agencies generally offer three kinds of services: direct instruction to students and adults, instructional support for teachers and administrators, and management support to local school systems. Common examples are:

#### ■ Direct Instruction to Students and Adults:

- Disabled student programs
- Vocational and technical education
- Occupational education
- Gifted and talented student education
- Environmental education
- Hospital and homebound instruction
- Juvenile retention education
- Adult education

#### ■ Instructional Support for Teachers and Administrators:

- Curriculum development services
- Staff development for teachers
- Staff development for administrators

#### Instructional resources library services

#### Technology support services

#### Counseling and guidance services

#### School health services

#### School social work services

#### ■ Management Support to Local School Systems:

- Program audits
- Computer services
- Cooperative purchasing
- Print services
- Financial planning
- Facility and energy management planning
- School improvement planning
- Legislative monitoring services

Twenty-nine states have education services agency networks, and there are roughly 750 education services agencies within these networks. No one agency offers all these services, and some agencies are highly specialized, offering only a handful of services. ■ERS

“constant” or “regular” use of their service agencies, and three-fourths reported that their districts depended on their service agencies “often” or had an “absolute need” for staff training, support, and information. Those school systems that make use of the programs and services rated them “better than average or very high in value.” The most highly prized instructional services included instructional media and assistance in math, reading, and writing instruction. The most valued noninstructional services included administrative data processing, financial accounting, cooperative purchasing, and driver training.<sup>8</sup>

#### Constancy and Change

Both constancy and change characterize the 30-year-old education services agency movement. There does not appear to be any wavering from the original commitment to support the networks. The expectations were, and continue to be, that the networks should enhance the efficiency, effectiveness, and quality of all schools, especially those in rural areas.

Nonetheless, differing perspectives and approaches on how best to judge the performance of the network are the source of another, and troubling, constant: periodic efforts in a number of states to either eliminate networks or redesign them in fundamental ways.

Though turmoil surrounds many of the state networks, only one has been dissolved—the Kentucky Educational Development Centers, initiated in 1972 and abolished in 1976.<sup>9</sup> The most common complaint has been the number of education services agencies in some states. A few states—among them New York, Ohio, Oregon, Washington, and Wisconsin—have reduced

the number of units in the state network. And some states have used a combination of services agencies to provide highly specialized services such as data processing and technical assistance in the development of local school technology plans.

While not widespread, some education services agencies have experienced major reductions in state aid in recent years; others have experienced the opposite. The motives behind the reductions seemingly center on the hope that by reducing dependence on state aid, the education services agencies will be forced to compete with other service providers and thus be more responsive and accountable to local systems in their service regions. State networks that have received significant increases in state aid have also been given additional responsibilities.

Some of these responsibilities are part of state school improvement agendas. For example, some agencies have been given lead roles in providing assistance in the alignment of content standards, student assessment, and staff development. Other examples include planning and technical assistance in the instructional use of technology, early childhood education, and strategic planning for schools and communities that are trying to address the rising expectations for public education.

#### Issues and Answers

The concept of a state network of service agencies, of course, raises certain questions. Most center on the absolute need for clarity in the networks’ missions—for example, are these agencies to perform only those services requested by constituent districts or those mandated by the state? How are policies to be made consistent and cohesive? How

are education services to be governed? Should it be by a popularly elected board, by representatives elected by constituent school boards, or by staff from constituent schools? How are they to be financed—by user fees, local taxes, state aid, or a combination of the three? And how are they to be held accountable to multiple stakeholders, including local districts, the public, and the state?

Despite these critical concerns, state education services agency networks have served for many years and in many ways as true partners of rural school systems. These agencies have been essential not only to rural systems, but also to the states trying to strengthen their entire education systems—enhancing teaching and learning in all schools regardless of location—while facing potential legal challenges surrounding school finance issues. For example, a number of recent state court cases have introduced the concept of “adequacy criteria.” In essence, the courts are asking if schools have adequate resources with which to meet the increased expectations being placed upon them.

While only 29 states have education services agency networks, those same states have often found the networks to be saviors for their rural schools. With limited funds, lack of specialized skills, and no outside help, rural schools often cannot compete with large urban and suburban school systems. Education services agencies can provide part of the solution. They are certainly worth looking into by those states that have not yet given them a chance.■

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## NOTES

1. The federal regulations for the 1998 amendments to the Individuals with Disabilities Education Act include an expanded definition for education services agencies that now reads: "The term 'educational service agency'—(A) means a regional public multi-service agency—(i) authorized by State law to develop, manage, and provide services or programs to local education agencies; and (ii) recognized as an administrative agency for purposes of the provision of special education and related services provided within public elementary and secondary schools of the State; and (B) includes any other public institution or agency having administrative control and direction over public elementary or secondary schools." 20 U.S.C. §1401(4). Education services agencies operate under many

different names. In Iowa, for example, they are known as area education agencies, while in Texas they are called education service centers.

2. E. Robert Stephens and Hobart Harmon, "Cost Analysis Studies of Programs and Services of State Networks of ESAs," *Perspectives 2* (Fall 1996), pp. 17-18.

3. Note that while the emphasis here is on education service agency partnerships with rural school systems, many organizations serve metropolitan areas, collaborate with large school systems, and span a large urban district and its suburban and rural neighbors.

4. J.P. Sher and R.B. Tompkins, whose work on behalf of rural education in the 1970s is justifiably credited by many as instrumental in reawakening the nation to its neglect of rural schools, offered the observation that forced rural school district reorganization was the most successfully imple-

mented national policy of the prior half-century. See J.P. Sher and R.B. Tompkins, *Economy, Efficiency, and Equality: The Myths of Rural Schools and District Consolidation* (Washington, DC: U.S. Department of Health, Education, and Welfare, the National Institute of Education, 1976), p. 1.

5. E. Robert Stephens and Kim Good, *AEA System Evaluation* (Oak Brook, IL: North Central Regional Educational Laboratory, December 1998).

6. *Ibid.*, p. 55.

7. *Service Centers 2000*, Report of the Task Force Service Centers 2000 (Austin, TX: Texas Education Agency, August 1996).

8. *Ibid.*, p. C-1.

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# Linking School-to-Work and Rural Development

*School-to-work initiatives can be an important policy tool  
for rural development.*

BY HOBART L. HARMON

**I**n 1994, President Clinton signed the School-to-Work Opportunities Act to help states better prepare their students for entering the workforce. Too often, youths just out of school are ill-prepared for today's high-skill jobs, and employers are finding it increasingly difficult to locate suitable workers, especially at entry-level positions. The School-to-Work Opportunities Act was designed to help rectify this problem. One of the side benefits of the act is that it can be a valuable tool for rural development.

Although an earlier law, the 1917 Smith-Hughes Act, established fed-

eral support for vocational education of selected students, the School-to-Work Opportunities Act was the first federal legislation to declare that preparation for earning a living is one of the legitimate and important roles of schooling for all students. The School-to-Work Opportunities Act also established a national framework within which each state can create a statewide school-to-work system that gives all students an opportunity to earn transferable credits, prepare for first jobs in high-skill careers, and pursue further education.<sup>1</sup>

On behalf of their states, governors submit an application to the

National School-to-Work Office for a five-year implementation grant. Applications describe the state's plan for building a school-to-work system, including how the state will serve students from rural communities with low population densities. Local partnerships may also apply directly to the national office for an implementation grant. These competitive grants are made to local school-to-work partnerships in urban and rural areas marked by high poverty.

The first and most important policy issue in rural education is to determine the appropriate relationship between local communities and the larger society and the way in which that is expressed in schools.<sup>2</sup> As public education struggles to reconnect schools with the public, creating community-oriented policies will be critical for guiding and sustaining implementation of school-to-work programs in rural areas.<sup>3</sup>

## Key Components

Building the school-to-work system at the state and local levels requires local partnerships to implement programs that address three key components: school-based learning, work-based learning, and connecting activities.

■ School-based learning focuses on career exploration and counseling, student selection of a career major, and instruction that integrates academic and vocational learning. It requires building a program of study based on high academic and skill standards, with scheduled evaluations of students' academic strengths and weaknesses, as well as procedures for facilitating student participation in additional training or post-secondary education.

■ Work-based learning includes job training, paid work experience, workplace mentoring, and instruc-

tion in general workplace competencies and should be tailored to fit needs of particular industries and students.

■ Connecting activities create a bridge between students at school and in the work environment. These activities link program participants, community services, and youth development activities with employers' strategies for upgrading the skills of their workers. Examples include matching students with work-based learning opportunities, providing school-site mentors who can act as liaisons for the student between school and work, and providing technical assistance to employers or others in designing school-based learning activities. Training teachers, mentors, and counselors as well as integrating academic and occupational education are important aspects of these activities.

Policymakers should be wary of prescriptive formulas and formats, however. There is no single, simple transition from school to work, and efforts to enforce the use of prescribed program designs are likely to provoke considerable local opposition.<sup>4</sup>

#### Rural Development

Every community is different, and the elements contributing to successful local development vary from place to place. Moreover, when successful development in rural communities does occur, it frequently depends on the special initiatives, local attitudes, or leadership of individuals who prove the experts wrong. Regional, national, and international economic forces also strongly influence what happens locally, and the communities themselves have limited control over these forces. And, too, communities can exhibit a marked lack of understanding of the major elements that give rise to local

economic success.<sup>5</sup>

Because of the great diversity in rural America, recommending a single best model for linking school-to-work efforts and rural development seems unlikely and unwise. What is true in the aggregate may not be valid for individual communities. Understanding broad development trends enables policy analysts and local decision makers to do a better job of evaluating the odds of success for each development option.

Rural development researchers, in fact, have identified several development trends that may have significant implications for school-to-work programs:<sup>6</sup>

■ Pressures of international competition will force steady increases in agricultural and manufacturing productivity. Such pressures generally translate into expanding output while reducing jobs. Any hope of maintaining, let alone expanding, rural employment will require local communities to turn toward other sectors of the economy, such as tourism and government activities. Promoting tourism, however, can be an uphill battle for school-to-work leaders because it evokes undue criticism from those who see tourism as creating mostly low-pay jobs with limited career opportunities.

■ Fiscal constraints and accountability for public tax dollars make the creation of large, new rural programs almost impossible. Furthermore, pressure on existing programs will inevitably continue, requiring innovation if these programs are to survive. Government programs must be increasingly cost-effective, they must leverage private sector funding, and they must appeal even to those who might not benefit directly. For example, in rural communities where few residents have children in school, school-to-work

programs must appeal to the larger population and community leaders.

■ The importance for rural areas to link with thriving metropolitan areas means that efforts must be intensified to find effective substitutes for geographic distance. Rural policy should focus on advanced telecommunications that give rural communities more complete, timely access to information, and it should lower barriers to rural participation in the telecommunications economy. Policymakers should promote technology that creates high-skill, high-wage jobs in rural areas; outmigration of rural youth may not have to be a necessary outcome of successful school-to-work initiatives.

■ Community isolationism is the antithesis of community survival. Small rural communities must break down political boundaries and form new cooperative units for education, service delivery, and public entrepreneurship—units that more closely correspond to the real scope of contemporary rural economic and social life. Recent trends suggest that only through such consolidation can many of the smaller communities hope to avoid continuing decline and eventual extinction. Education policymakers must learn to reach across school district lines and collaborate with one another to implement school-to-work programs that advance both local community and regional development efforts.

■ Many analysts conclude that the real source of the wealth of nations in the next century will be the skills and cumulative education of the workforce—the new keys to competitiveness. The gap between rural and urban education and training levels is frequently regarded as a source of rural disadvantage. One major comprehensive study, however, rejects the thesis that low skills are a cause of rural economic mis-

fortune or that increased rural education and training would serve as a cure.<sup>7</sup> The reason for that rejection is population mobility across regions, as persons trained in one region move to another to find work. Many reasons exist for local communities and state and federal governments to embark on a new partnership to upgrade education and training. But rural communities should be under no illusion that such initiatives by themselves will suffice to create local job opportunities and prevent the outflow of young people.<sup>8</sup>

#### Adapting to Change

Appropriately planned school-to-work initiatives must address common weaknesses in a shifting rural economy. Rural America is weakest in those areas of economic activity generally considered most vital to national competitiveness: product innovation, management innovation, information development, high value-added services and production, and technical knowledge.<sup>9</sup> Importing people and dollars, rather than exporting raw materials and manufactured goods, reflects the transitions underway in many rural economies. Tourists and their dollars travel into the countryside for short-term visits, while retirees and government facilities come to set up residency. Old sources of rural comparative advantage, such as cheap land and low-wage labor, are being replaced by a new one: quality of life.

Successful rural development requires the ability to see opportunities where others see only liabilities. Thus, visionary entrepreneurship is key to successful rural development.<sup>10</sup>

Improving rural schools strictly in terms of student achievement on standardized tests may fall far short of what is needed for rural schools to link school-to-work programs

and economic development.

When building a successful school-to-work system, each rural community must decide whether to emphasize education, job creation, or overall community development, based on the needs of the area and what the community will support. The community's values, population makeup, and political environment will be important considerations. To ensure community support, community leaders need to be identified, and the entire community needs to be informed and involved. Maintaining a solid base of information about available resources and collaborating at all levels and with all sectors of the community and with state, regional, and national organizations and agencies will help ensure success.<sup>11</sup>

Deciding how to equitably allocate school-to-work funds among rural and urban communities—a task seldom easy in states with difficult rural and urban choices—is also critical. In Arizona, for example, rural areas may be getting short shrift because school-to-work resources are not concentrated in rural communities, even though the educational and economic development needs of rural communities are proportionately greater. As education researchers in Arizona note:

Reforming schools in rural areas without focusing equal attention on economic development will only exacerbate the “brain drain” whereby the brightest students leave to seek education and employment in urban areas. On the other hand, establishing high performance workplaces in rural areas without a skilled labor force is imprudent. State policies are needed that proactively help rural areas out of the Catch-22 in which they are trapped, i.e., need-

ing a skilled workforce to foster economic growth and needing businesses and industry to foster the education and training of a skilled workforce. To fail to create such policies is to accept the fact that rural areas will continue to be plagued by unemployment, poverty, and their social consequences.<sup>12</sup>

#### Possible Linkages

Unfortunately, little information is available describing how the national school-to-work transition effort affects rural development. This is not to say that isolated examples do not exist. Rural school-to-work partnership grants awarded to federally designated Enterprise Communities demonstrate that school-to-work efforts can help meet local community and economic development needs.

The East Tennessee Enterprise Partnership in Scott County, for example, received a grant from the National School-to-Work Office to establish a school-to-work partnership. Rather than being just another educational initiative, the partnership aims to improve the local economy by creating entrepreneurial opportunities in the community and by equipping students to take advantage of them.

Apparently undocumented, however, are the lessons learned from Scott County and other sites. For example, we don't know how school-to-work initiatives improve quality of life and global competitiveness. Nor do we have information on how the school-to-work transition movement has been linked with the National Rural Development Partnership—a partnership between the private sector and governments at all levels.

Some states have replaced the term *school-to-work* with *school-to-*

career because of parental concerns about the term. How this has played out in rural areas is unknown, yet such information may help policymakers to better link education reform efforts with rural development strategies.

The National School-to-Work Learning and Information Center—a federal center set up to help states implement the School-to-Work Opportunities Act—offers a variety of strategies for linking school-to-work programs and economic development. For example, school-to-work partnerships can coordinate activities with local and regional economic development organizations, encourage formation of groups of businesses that have common training needs, and build comprehensive community-wide networks that incorporate education, economic development, employment, and training.<sup>13</sup>

By establishing human resource investment councils, building community-wide collaboration, and serving at-risk and out-of-school youth, school-to-work efforts can be integrated with other education and training initiatives into a comprehensive system for providing all youth with pathways to successful careers.<sup>14</sup>

### Winds of Change

The task of linking school-to-work transition efforts with rural development has just begun. Most of the school-to-work information available to policymakers does not specifically address rural areas, and many questions remain unanswered. Nonetheless, the school-to-work concept apparently has arrived at a time when public education and rural development advocates are pushing collaborative partnerships and applications of technology to

sustain rural schools and their communities well into the 21st century.

If school-to-work programs are to capitalize on these changes and help build local communities while preparing students to live and work in either a rural or urban setting, perhaps it is time to leverage public and private support for a more focused initiative, one that addresses the specific needs of rural development. The school-to-work program is only one small tool, but it can be an important one for helping to reshape the landscape of rural America.<sup>15</sup> ■

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12. A. Danzig and J.A. Vandegrift, "Tensions Between Policy and Workplace Opportunities in Arizona: Does Public Policy Ignore Social Equality?" Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA: April 4, 1994), p. 21.

13. The National School-to-Work Learning and Information Center maintains a website at <<http://www.stw.ed.gov>>, which provides access to a vast collection of many resource documents. For example, a resource bulletin entitled "School-to-Work and Economic Development" (January 1997) is available at <<http://www.stw.ed.gov/factsht/bul0197b.htm>>.

14. Ibid.

15. For example, the Rural Challenge (now called the Rural School and Community Trust) is a five-year initiative begun in 1996 with a \$50 million grant by the Annenberg Foundation, to improve public schools in rural areas. The initiative is guided by a philosophy that schools and communities serve each other. The Ford Foundation made a decade-long commitment in 1995 to support a Rural Community College Initiative, to enhance the capacity of community colleges to expand access to post-secondary education and help foster regional economic development in specific rural areas facing outmigration and stagnant or declining economies.



# Engines of Growth

*Rural community colleges are continuing to reinvent themselves in the face of changing demands and lagging support.*

BY STUART A. ROSENFELD AND CYNTHIA D. LISTON

**F**ocused as they are on the students, businesses and problems of their particular locales, rural community colleges around the nation have emerged as powerful economic catalysts for the communities they serve. In fact, because they shape their programs and course offerings to meet the needs of the regional economy—in the process, adapting to technological advancement, welcoming any and all students, and giving those students the skills desired most by local industry—community colleges have become the educational institution of choice for many rural businesses.<sup>1</sup>

Community colleges have not always focused so heavily on economic development, however. Beginning as feeder schools, these “junior colleges” initially were concerned primarily with preparing students for matriculation at four-year institu-

tions. Yet one of the biggest advantages of community colleges has been their ability to adapt—both in terms of curriculum and mission—to changes occurring in the greater community.<sup>2</sup> As a consequence, after World War II, community colleges became vocational schools, targeting the growing semiskilled industrial workforce.

In the 1960s, they changed again, as a few states reinvented their community colleges to more directly support industrial development. These reinvented schools mainly, and sometimes solely, offered vocational and technical programs, customized training for companies, and continuing education. In the process, they paid close attention to supporting the specific training needs of manufacturers that were increasingly choosing rural locations for establishing branch plants. By the mid-1970s, nearly every state had likewise reoriented

its community colleges in hope of competing for new plant locations.

In the 1980s, some colleges became more aggressive in economic development by establishing advanced technology centers and by acting as intermediaries between industry and the new technological development. These colleges spurred modernization of small and mid-sized enterprises and increased demand for higher-level skills. In 1989, a North Carolina commission on community colleges identified as one of its strategic challenges the need to support the development of small businesses and to help business and industry adapt to changes in technology.<sup>3</sup> This emphasis grew stronger in the 1990s, driven by increasing educational and skill requirements among employers and by the widespread adoption of information technologies.

Today, most community colleges in the nation adhere to some mix of missions, but economic development leads the way. Indeed, in a 1995 national survey of 100 community colleges, 90 percent of those responding referred to economic development or modernization services in their mission statements.<sup>4</sup>

## What's Next?

To meet the changing demands of the new century, community colleges must continue to reinvent themselves. The question is how. Since many of the conditions and trends likely to influence rural community colleges over the next decade are already in place, we can predict their future course with some certainty.

Perhaps the most powerful of the new trends is the spread of information technologies. These technologies change not only what business does but also how it does it. Information technologies also affect

how and what people learn, and as a result, they influence what and how community colleges teach.

Another important trend is the rising competition from for-profit and proprietary schools like the University of Phoenix and DeVry Institutes. Meanwhile, corporate universities at companies like Motorola, Sun, and Ford—which currently number about 1,600 nationally—and Internet-based education programs offered by the public and private sectors are also competing with community colleges for students.<sup>5</sup>

Yet another trend is globalization, which forces colleges to think and act globally, for instance, by preparing students to understand foreign markets and customs. Tim Koogle, the CEO of Yahoo, claims that “there is probably no business today that you can start that can afford not to be global.”<sup>6</sup>

Changing occupational patterns also affect community colleges. In the 1970s and 1980s, when manufacturing was still the backbone of the rural economy, top community colleges targeted that sector. Today, colleges cannot ignore the rising service sector—especially those services linked to technology.<sup>7</sup> Research shows that office occupations—even within manufacturing companies—are growing much faster than production jobs and now pay as well or better.<sup>8</sup>

Finally, many community colleges suffer because of the public perception that two-year technical degrees are the equivalent of the old industrial-education degree, while four-year degrees lead to higher status and higher pay. As a consequence, community colleges are finding it hard to attract students into their certificate or associate-degree programs. Some community colleges are therefore adding baccalaureate degrees.<sup>9</sup>

### Rising to the Challenge

In response to these trends, community colleges must reinvent themselves yet again in ways that will improve opportunities for all people in rural areas. Following are nine overarching goals that should drive that reinvention.<sup>10</sup>

■ **Facilitate further education.** More students now want credits for classes that can be counted toward a recognized degree and that will expand their employment options. To maintain enrollment and meet the rising demand for credits and degrees, community colleges will have to make their technical courses count toward four-year degrees and perhaps offer a new three-year applied technical B.A. degree, as some European technical institutions already do.

At the same time, shortages of technicians are likely to increase as students aspire for higher education and forgo technical training and jobs. Community colleges can help overcome this shortage by educating parents, women, and minorities about technical career options. Parents should be targeted because they play a major role in influencing their children’s career choices, while women and minorities should be targeted because they have traditionally been under-represented in technical occupations.

An example of a school that has successfully increased enrollment in technical programs to overcome skill shortages is Oklahoma State University’s two-year technical branch at Okmulgee. In 1995, the school began a statewide, summer manufacturing academy for 14 and 15-year-olds. Its purpose is to educate youth and parents about today’s manufacturing environment and to attract young people to technical employment.

Trident Technical College in

Charleston, South Carolina, provides another example. As part of a consortium of five small manufacturers, the college sponsors a recruiting and training program for high school seniors. The school’s objective is to fill the manufacturers’ needs for entry level workers.

■ **Enable life-long learning.** After a quarter century of recommendations by a multitude of studies and commissions, the goal of life-long learning is becoming a reality, largely because the information-technology sector requires constant skill upgrading and aging baby boomers want to keep learning. Through flexible scheduling and innovative learning technologies such as the Internet, community colleges can become the preferred institutions for returning adults.

Since most workers are unable to attend regularly scheduled daytime classes, evening class enrollment far exceeds day enrollment in many colleges today. But community colleges can, and should, do more to serve this population of students. Specifically, they should create a highly flexible environment in which faculty can schedule not only a wide range of evening and weekend classes, but also offer concentrated programs that cover the material in less time. They should also offer classes at remote sites. These steps will enable even more students to upgrade their skills and acquire credentials.

Despite flexible scheduling, many workers who wish to upgrade or acquire new skills simply cannot always make it to a classroom at a prescribed time. Work schedules, transportation constraints, or family obligations get in the way. Computer and Internet-based programs give these students the flexibility they need while still allowing them to interact through the Internet

with their instructors and other class participants. Furthermore, a large number of databases such as Regional Technology Strategies' *ConnecTech* and the U.S. Department of Labor's *Learning Xchange* are devoted to improving access to Internet-based education by centralizing information about various colleges' distance-learning programs so that students can find the courses that best suit their interests.

Because of the stiff competition for students, community colleges should focus their own Internet-based courses on their strongest and best-known programs. Colleges might also combine Internet courses with occasional classroom training for subjects that do not readily lend themselves to complete distance delivery or for the many students ill-prepared for online learning because of poor computer skills.

■ **Build learning communities.** Regional economic development increasingly depends on the quality of a region's learning environment, and community colleges are well positioned to help rural areas establish themselves as learning centers. Community colleges are beginning to realize the value of learning from and cooperating with other educational institutions as well as with businesses, industry groups, vendors, associations, and community organizations.<sup>11</sup> Such collaboration is particularly important to rural college staff, who are often isolated from their peers.

A good example of a learning community is the Rural Community College Initiative, an alliance of 24 community colleges in economically distressed areas throughout the nation. Managed by MDC Inc., RCCI brings colleges together to jointly address common needs such as supporting entrepreneurs, providing distance learning, and

building community partnerships.<sup>12</sup>

Another example, the Manufacturing Technology Center in southwest Virginia, comes with an added benefit to both manufacturers and faculty. The technology faculty from the five rural community colleges that sponsor the center have the opportunity to work in companies during the summer through the center's "back to practice" program.<sup>13</sup> A key goal is to refresh instructors' familiarity with modern manufacturing. The colleges also gain useful industry connections, and the companies get professional help with production challenges and problem solving.

■ **Participate in regional planning.** Because of their connections to small and mid-sized businesses and their access to information about labor, job markets, and technological changes, community colleges have special perspectives on a region's strengths and needs. These colleges therefore can make a unique contribution to regional planning by participating on regional strategic planning teams, not just as advisors but as full partners.

In some cases, sharing office space facilitates this effort. The 10-year-old Advanced Technology Center at Hagerstown Community College hosts an office of Maryland's manufacturing extension service. It also boasts a small-business development center, and it houses the state's regional technology council and the offices of a four-county economic development agency. This arrangement encourages collaborative regional development and makes the college a primary hub of the region's development activities.

■ **Promote problem-solving skills.** Companies want employees who can think critically, solve complex problems, and communicate well. Unfortunately, there is evidence that

community colleges are good at teaching technical skills but not skills in thinking and communications. Community colleges must begin teaching from a systems perspective, embedding competencies in complex situations—from design to production lines—that resemble the real world. Such a context will more effectively teach problem-solving skills.

Indeed, according to Professor Norton Grubb of the University of California at Berkeley, "A systems approach is necessary for problem solving: if students don't know how a system works, they cannot identify what might cause a failure."<sup>14</sup> To produce a workforce that understands systems and enterprises, innovative colleges will need to move even further toward systems approaches.<sup>15</sup>

■ **Go global.** Neither colleges, businesses, nor students can afford to assume that the best work opportunities, markets, practices, and ideas are found solely within U.S. borders. Consequently, well-prepared students will have to understand cultures, economic systems, and business environments in other parts of the world. Further, faculty and administrators will need to search the globe for solutions to problems and opportunities for innovation. The Trans-Atlantic Technology and Training Alliance, comprising 28 U.S. and European technical and community colleges and managed by Regional Technology Strategies, for instance, allows members to exchange information and collaborate across national boundaries.<sup>16</sup> In the process, it raises the benchmark for local activities and connects even small rural areas into the global system.

■ **Target niches.** Competition from other education providers will force community colleges to target niches

and develop specialized expertise. Since technical colleges are regional, the niches ought to relate to the needs of the regional economy and its industrial clusters. The more specialized the local economy, the easier the choices become.

The more prominent specialized college centers of excellence are located in the midst of strong business clusters. For example, Catawba Valley Community College in North Carolina runs the Hosiery Technology Center; Itawamba Community College in Mississippi emphasizes the furniture industry; Ayr College in Scotland and DeAnza Community College in Silicon Valley emphasize electronics specialization; and West Virginia University at Parkersburg emphasizes the chemical processing industry.

■ **Nurture business leadership.** In regions with little social capital—that is, the institutions, relationships, and civic involvement necessary for development—colleges can stimulate interaction among industry players that leads to stronger civic and economic climates. Colleges should sponsor forums that allow business leaders to meet regularly, discuss common training and technology needs, and address shared problems. Taking this a step further, colleges can create and facilitate more formal alliances such as business networks that collaborate on matters of mutual benefit and concern.

Okaloosa Walton Community College in Florida and Oklahoma State University's Technical Branch at Okmulgee, for instance, both initiated business networks in the early 1990s for members to address pressing opportunities and issues. Both remain very active. An ancillary benefit of these networks is the communication link they forge be-

tween industry and local colleges.

■ **Support innovation.** Colleges employ many innovative faculty members and administrators who, given the opportunity, might directly solve business and industry problems or solve them indirectly by devising better education and training methods for their students. Colleges should support such individuals through an institutional culture that encourages risk taking and acknowledges success.

At Haywood Community College in the mountains of North Carolina, entrepreneurship has become an institutionwide goal. In 1997, the college chose to focus on entrepreneurship for its alternative accreditation process. In so doing, the college inculcated entrepreneurship across its curricula to support the local rural economy, and it also reorganized and operates entrepreneurially as an institution. For example, some college staff have gone through the same entrepreneurship curricula that students take, and an Entrepreneurial Learning Team meets regularly to decide activities to keep faculty and staff on target with the college's entrepreneurship mission.

#### It Takes Money

Community colleges have proven extremely adaptable in the past. Furthermore, they are generally acknowledged as vital to technological innovation in their regions. Thus, they will not simply make the transition to a knowledge-based economy, they will likely be among the leaders in the charge. Finances, however, will present an important barrier.

Despite their accomplishments, community colleges are undervalued and underappreciated, particularly by state legislators. With no federal legislation to legitimize

them, and sandwiched as they are between the widely championed and visible public schools and the heavily endowed universities, community colleges have to fight for recognition and budgets. Those funds they do get are generally inflexible and tied to full-time-equivalent enrollments, even though the vast majority of their students attend school only part time. Community colleges have become engines of growth, but they will need generous, flexible support if they are to continue to assist rural economies in reaching the global economic table.■

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#### NOTES

1. Organization for Economic Cooperation and Development, *Regional Competitiveness and Skills* (Paris: OECD, 1997), p.50-51.

2. The adaptability of community colleges is partly due to their need to reinvent themselves to gain support and legitimacy. Although community colleges were first recognized in the federal vocational education legislation in 1963 with a set-aside, the act was written for secondary schools. Furthermore, support is authorized by the Higher Education Act, but it was written for four-year institutions.

3. Commission on the Future of the North Carolina Community College System, *Gaining the Competitive Edge: The Challenge to North Carolina's Community College System* (Raleigh, NC: MDC Inc., 1989).

4. Stuart Rosenfeld, *New Technologies and New Skills: Two-Year Colleges at the Vanguard of Modernization* (Washington, DC: American Association of Community Colleges, 1995).

5. Tony Zeiss, "Will Our Students Become Theirs?" *Community College Journal*, 68

(June/July, 1998), pp. 8-13.

6. Victoria Shannon, "Silicon Valley Offers Europe a Recipe for Success," *International Herald-Tribune*, September 23, 1999.

7. Melissa Barfield and Lionel Beaulieu, *The Changing Nature of Work in the South: The Polarization of Tomorrow's Workforce* (Mississippi State, MS: Southern Rural Development Center, 1999).

8. Anthony Carnevale and Stephen Rose, *Education for What? The New Office Economy* (Princeton, NJ: Educational Testing Service, 1998).

9. Barfield and Beaulieu, *The Changing Nature of Work in the South*. Projections indicate that only 4.1 percent of occupational demand between 1996 and 2005 will require an associate degree.

10. These principles assume two things: First, colleges will have enough computers

and broadband telecommunications services to meet the needs of complex web-based education, training, and collaboration. Second, colleges will continue, and even increase, efforts to reach and educate underserved populations.

11. Phillip Cooke and Kevin Morgan, *The Associational Economy: Firms, Regions, and Innovation* (Oxford, UK: Oxford University Press, 1998).

12. MDC Inc. is a nonprofit organization that develops policies and programs to help strengthen the workforce and promote economic development in communities around the nation. Its primary focus, however, is on the South. Its homepage can be found at <<http://www.mdcinc.org>>.

13. The Manufacturing Technology Center provides technical assistance and training to the manufacturing industry in southwest Virginia to improve their competitiveness

and to create economic opportunity in the region. The center's website is <<http://www.mtcofswva.org/>>.

14. W. Norton Grubb, "Preparing for the Information-Based Workplace: Pedagogical Issues and Institutional Linkages," forthcoming in *Learning Now: Skills for the Information Economy* (Washington, DC: Community College Press, spring 2000).

15. W. Norton Grubb, ed., *Honored but Invisible: An Inside Look at Teaching in Community Colleges* (New York: Routledge, 1999).

16. Regional Technology Strategies Inc. is a private nonprofit organization, located in Carrboro, NC, that is dedicated to improving the standard of living in the United States by promoting regional economic growth and development. More information about the organization can be found at <<http://www.rtsinc.org/>>.



# Communities as Curricula

*Efforts to prepare students for the real world shouldn't ignore the learning environment that lies just beyond the schoolhouse gate.*

BY PAUL THEOBALD AND JIM CURTISS

In *The Rise and Fall of the American Teenager*, Thomas Hine argues that the educational format found in most U.S. high schools contributes to the malaise so widespread among teenagers today.<sup>1</sup> In a bold statement, Hine contends that James Bryant Conant's archetypal high school, outlined in 1959 and copied widely thereafter, was a huge societal mistake.<sup>2</sup> This high school, Hine argues, effectively condemns adolescents to an extended period of uselessness in terms of their connection to society. With no effective way to make a contribution to others, high school students turn inward, ceaselessly brooding about themselves and contributing to what Christopher Lasch referred to as the "culture of narcissism." If Hine's analysis is even partially cor-

rect, the American school system is in need of serious rethinking.

Taken by himself, of course, Hine is simply a minor critic of the status quo. But his analysis resonates with a growing academic movement in this country that comes together under the loose heading "communitarianism." Put simply, scholars from a range of disciplines are asking what their subject of study might look like if community were substituted for economic gain as the primary human motive. For instance, what would our political theory look like if we valued community more than profit? What about our economic theory? Or our educational theory?<sup>3</sup>

While putting community ahead of profit, of course, would necessitate great changes in all of these arenas, our interest is in education.

Most Americans accept as a given that schools are designed to help children acquire the knowledge and skills required for future employment.<sup>4</sup> This, however, is a far cry from the schools' original purpose. When free schools were established in this country, the goal was to provide a common education so that the people could effectively wield the power that was theirs by virtue of living in a democracy. In other words, schooling was about improving life, not by enabling individual acquisition in the marketplace, but by setting up better deliberation in the policy arena.

## Students as Citizens

Happily, evidence suggests that attention to this earlier purpose is on the rise. The professional literature, for instance, is full of references to character education. Likewise, large cities everywhere are trying to bring back the neighborhood school. The idea behind both of these developments is that fostering attention to others, cultivating an ethic of being of service to others, especially to those who share a place, or a community, ought to be a high priority of education today. Nonetheless, the literature is also replete with schemes for doing what we have been doing for the past century and doing it with more intensity or fervor. The current manifestations of such schemes are standards, vouchers, charter schools, and still more standardized testing.

But there are enough compelling arguments to convince policymakers to rethink some basic premises. At a minimum, they should ask themselves whether statehouse decisions on public education tend to build up or tear apart communities.

School consolidation provides a classic example. Taking their cues—or their legitimation—from

Conant's pronouncements that high schools should be no smaller than 100 kids per grade, legislators in virtually all states have closed down small rural community schools, condemning these places to a hopelessness about their vitality—present and future. We have sent the message—via our policy choices—that community is unimportant. In its place has come the message that life is about getting ahead, keeping up with the Jones's or having things your way.

It should be no surprise then, given the pervasiveness of such messages, that character is in short supply in our society. Indeed, the evidence suggests that the destruction of American communities via school consolidation may yet come to be viewed as one of the colossal mistakes of the 20th century. History affords no example of societies that have sustained themselves by cultivating an anticommunity, pro-self policy orientation. Yet this is where we are.<sup>5</sup>

So what is to be done? The answer is simple: use schools as a source of community renewal rather than a cause of community disintegration.

It's worth noting that community-oriented pedagogy, or what some call place-based schooling, has great practical value even if the goals remain producing the highest record of achievement in traditional school subjects and increasing pure economic utility. The reason lies in what we have come to understand about learning.

#### Learning Theory Primer

A discussion of community-based curricula and their relevance to learning theory is all but unthinkable without reference to the educational thought of John Dewey. Consider the following passage from "My Pedagogic Creed" in which

Dewey lays the foundation for a community-based curriculum:

The only true education comes through the stimulation of the child's powers by the demands of the social situations in which he finds himself. Through these demands he is stimulated to act as a member of a unity, to emerge from his original narrowness of action and feeling, and to conceive of himself from the standpoint of the welfare of the group to which he belongs.<sup>6</sup>

In that essay, Dewey claims that social situations fostered by active community membership together with educational experiences within a community are crucial to the very best kinds of learning. This involvement and immersion in a community promotes what today is called a constructivist approach to teaching and learning. This means that students, immersed in the context of community, *construct* important meanings and understandings through interaction with that community environment.

Constructivist educators contend that the background knowledge, previous experiences, and fundamental world view of students profoundly affect their interpretation of subject matter in the school curriculum. It is logical to conclude then that a rich foundation of experiences and knowledge within a cohesive community is crucial to an adequate education. In addition, children learn and construct meaning about the important social values and mores of the community.<sup>7</sup> From a constructivist point of view, early experience in a community is important to the developing child in two ways: it helps the child acquire concepts for future academic learning, and it provides the actual content of social and character educa-

tion. Community is thus potentially the teacher *and* the topic.

Constructivists also claim that students learn best when they apply their knowledge toward solving authentic problems in real contexts.<sup>8</sup> Citing Dewey, Alfred North Whitehead, Lewis Mumford, and other eminent scholars of a generation ago, today's constructivists believe that the school as a training ground for some future life is inadequate and incomplete. Culture, society, and community all change at a rate that precludes the isolation of children cloistered in schools while waiting for life to begin. Further, they argue, learning that is isolated from authentic circumstances fails to capture the student's most powerful and fundamental motivations. Dewey claimed that school should be life and life should be school for young people. Community-based curricula provide a natural setting replete with authentic and meaningful problems that draw on prior experiences and intrinsically motivate students to solve them.

Part of the intrinsic nature of the motivation stems from what appears to be a cross-cultural human desire to make a contribution to others. Some—like Thorstein Veblen early in the 20th century—refer to it as an instinct for "workmanship," while others point to the fundamentally social nature of human existence, citing countless cases of human isolation that resulted in derangement and, ultimately, premature death. Wherever motivation comes from, there can be no denying that students will perform better when the audience for their work is expanded from a single teacher to the community writ large. To be motivated learners, children need to see—concretely and immediately—the relevance of their efforts and the

good that results from those efforts. Learners need the community to provide this sort of relevance.

#### Cultivating Creative Thinkers

Constructivist educators also believe that education should engage learners in “sense-making” and it should strive for deep understanding of core ideas rather than simply the recollection of facts. In so far as the purpose of education is limited to mere training and inculcation, the old behaviorist methods found in traditional schools might be adequate. If, on the other hand, our children are to develop as critical and creative thinkers who construct meaning from their educational experiences, they will need more than teachers and textbooks. They will need a rich and varied environment, a whole community of players on a real-world stage.

Finally, constructivists emphasize the importance of dialogue and interaction to learning. Taking their cues from Lev Vygotsky—a noted Russian social psychologist—constructivists stress the importance of cultural mediation in cognitive development. In other words, cognitive development comes about because of an individual’s social interactions within her or his environment. These interactions, mediated by language and other symbol systems, are internalized as meaning and conceptual understanding. While it is possible for a lone teacher in a classroom to prompt some of these interactions, it stands to reason that the rich and varied context of a larger community will enhance the construction of deep meaning and understanding on the part of all children.

To summarize, constructivists emphasize previous knowledge and experience; authentic problem solving in real situations; learning cir-

cumstances that allow students to acquire the satisfaction that comes from making a contribution through their work to others who share their neighborhood or community; the need for deep understanding rather than shallow factual knowledge; and many varied interactions with peers and other community members. All of these components of constructivist learning theory suggest there is great utility in community-based curricula.

#### A Role for Standards

The current movement toward national goals, standards, and assessment might suggest that a community-based curriculum and a constructivist approach to its implementation are inappropriate today. At first glance, it would seem that the whole idea of a community-based curriculum is antithetical to any agenda of national goals or curriculum standards. Indeed, we argue that a tendency toward centralization of educational aims runs counter to the best education of youth. That notwithstanding, given a sensible and sensitive approach to national goals, we believe that students who are well taught in a community-based milieu can meet and easily exceed national and state standards.

According to Ron Miller, founder of the journal *Encounter: Education for Meaning and Social Justice*, a state is “an incredibly blunt and inappropriate instrument for administering the delicate task of supervising children’s moral, spiritual, and intellectual development.”<sup>9</sup> Among the many arguments Miller makes against standards, several support a community-based curriculum and constructivist pedagogy.

First, the learner’s active role in education is totally missing in the standards and goals agenda. If we believe understanding to be a con-

structive process requiring active engagement with the world, then a simple infusion of intellectual content will not help the learner in meaningful or deep ways. Subject matter that appears logically coherent to some people may not make sense to you or me because of our individual experiences. Constructivist learning theorists emphasize the need for assent or interest in genuine learning. A national curriculum, lacking the student’s collaborative efforts in its creation, can succeed only to the extent that the student is bribed or coerced into its engagement.

Second, national goals, standards, and curricula each demand the most simplistic, labor-free types of assessment available. While educators across the country have demonstrated that it is possible to make pedagogical contributions to student learning through the act of assessment itself, this contribution is forfeited by the reliance on a standardized exam, an assessment method—close to a cultural fetish in the United States—that by definition must leave context, the stuff that yields understanding, out of the picture. Further, this type of assessment leaves no stewardship role for community members in terms of the intellectual lives of their children. Parents must wait for the results and sit patiently while the intricacies of standardized scores and standard deviations are explained to them. An exceptional opportunity to create a better public is passed up as we relieve parents of their responsibility to take part in the assessment of youthful achievement.

Third, standards assume that students are equally prepared for educational achievement. This is clearly not the case. Because of developmental and experiential differences, students arrive at school with dif-

fering needs and expectations. Communities and cultures differ in terms of values, economic vitality, and expectations. Is it fair, practical, or even desirable to hold them all to the same standard? When per-pupil spending between school districts can differ by thousands of dollars, can we possibly hold all schools to the same standards?

#### Student Slaves

Finally, setting goals or objectives for other people is problematic. According to Dewey, "Plato once defined a slave as a person who executes the purposes of another."<sup>10</sup> He goes on to stress the importance of the participation of the learner in identifying the purposes that direct his or her activities in the learning process. Beyond the ethical dilemma created by imposing curricula on others, the global knowledge explosion itself seems to be an argument against a one-size-fits-all curriculum. Given the amount of knowledge available, it seems a disservice to deny access to portions of that knowledge in the name of curricular conformity—if such conformity were, in fact, possible.

Having argued against standards, we should point out that students educated in a caring democratic community using a constructivist approach can meet any reasonable standards. If excellent teachers resist the pressure to teach to the tests, a community-based curriculum should provide experiences in problem solving and critical thinking and should foster positive attitudes toward the people with whom they share the community. Therefore, though standards seem to be little more than a waste of valuable educational resources, they do not have to be an impediment to constructivist learning approaches within a community-based curriculum. In-

deed, we believe students thus educated will excel at meeting and surpassing standards.

#### Lessons from the Field

The skeptical reader will ask whether community-based curriculum theory, combined with constructivist instructional theory, can in fact guide the practice of teachers and schools. Can it be made to happen? The answer is an unequivocal yes, as illustrated by the following examples and countless others emerging from every corner of our country.

Howard, South Dakota, is a small town of about 900 residents in rural Miner County.<sup>11</sup> Like many rural communities, it experienced significant decline during the farm crisis of the 1980s. In 1994, a new principal came to Howard and asked his high school staff a question that is scarcely ever asked by school leaders: what can we do in the school to help this community? Most of the teachers were confused by this, but a few saw it as an intriguing intellectual challenge that helped them look at their jobs in a new way.

Using a mere \$500 obtained from a local university, Howard's business teacher, with the support of the principal, took students on the academic ride of their lives. The students conceived of a way to study the community's cash flow—how much was earned there, where it was spent, and what it was spent for. The students conducted town meetings with local business owners, consulted with the county auditor, and engaged in long debates with all stakeholders over the wording on their surveys.

It was a courageous undertaking, and the students were never shy about proceeding. They unabashedly asked community members throughout Miner County to reveal

the intimate details of their income and spending habits. When the surveys were collected, the students found themselves with a phenomenal 64-percent response rate and an enormous amount of data to analyze. Using sophisticated computer software, the students sorted the data by income level, spending location, spending category, and other parameters. All takes on the data revealed much the same lesson, however: the people of Howard spent most of their income in the larger and more distant cities of Madison, Mitchell, and Sioux Falls.

Student analyses of the data were reported in the local paper before the school year was out. The community response was a little short of amazing. When Howard citizens saw how much they were spending outside the community, they changed their spending habits. They bought much more locally. Revenue from local sales tax began to skyrocket. The county auditor reported that by the end of the summer, annual sales tax projections had already been exceeded. Based on the average number of times a locally spent dollar will turn over within a community, the county auditor estimated that the students had engineered a \$6 to \$7 million infusion into Howard's economy.

Needless to say, the Howard business students learned a good deal about economics, spending, saving, and the relationship between economic vitality and community well-being. They experienced what it feels like to do something worthwhile and to earn the respect of the community. The subject matter, the audience outside the classroom, the interaction with community members, and the constructive nature of the learning process all helped to heighten the students' academic achievement. And perhaps most im-

portant of all, the experience promoted that ineffable quality that all schools strive for: student character.

Since then, Howard students have been involved in many other community-based learning experiences. In fact, the town has established a reputation for being an innovative community that looks to its school for inspiration, ideas, and energy.

#### Rural Riches

While Howard represents a fairly spectacular example of the power of a community-based curriculum, there are many others that are equally, if not more, outstanding. The most famous is the long-standing Foxfire project in rural Rabun Gap, Georgia. The project, in existence for more than 25 years, got its start when students recorded oral histories from elders in the area and published them, first in a magazine, and then as books. Some of the books have been best sellers and the proceeds have been used to create a huge endowment for the project.<sup>12</sup> Other, less famous, examples include a small rural school in Alabama that created its own computer manufacturing company, one in South Dakota that opened a grocery store several years after the last such operation had closed down, and another in Wisconsin in which 6th graders opened a bookstore that ultimately generated enough profit that the students created a community foundation. In all cases, solid academic learning came with the added benefit of contributing to the well-being of the community.

Finally, an example from Elkhorn, Nebraska, demonstrates that a community-based curriculum need not be confined to rural schools.<sup>13</sup> At Skyline Elementary School, a 2nd-grade teacher fashioned a constructivist learning

project that allowed students to build a community from the ground up, so to speak. Each day, students played with this model community, gaining crucial insights and learning valuable lessons about the way people work, learn, and live together within a community. By playing with the community, Skyline students learned important social and academic lessons.

When problems arose in their play community, the 2nd graders used their own observations and past experiences, as well as their parents and other community members, as resources. In this way, they not only constructed roads, schools, hospitals, businesses, churches, and homes, but also courts, laws, and other agencies of general community welfare. At one point, a missing toy car resulted in a discussion of the appropriate balance between individual rights and obligations to others. These 2nd graders used the conventions, traditions, and democratic decision-making processes they saw at work in the real communities they grew up in. While learning these academic lessons, they also developed a new appreciation for the value of relationships, caring, and interdependence.

Although the 2nd graders played in school, the curriculum was community-based in that the students used their communal experiences to guide and inform their play. It was constructivist in that the children used those experiences to construct meaning and understanding about living in a community. The Skyline experience teaches us that young children can gather information about their community and build sophisticated understanding through the actual practice of democracy, expression of freedom, and recognition of community interdependence.

#### Community Well-Being

Consider the potential for the school district that orchestrates community-based curricular work on a K-12 basis. Students who play with community models in the 1st or 2nd grade and later undertake running a local book store or analyzing community cash flow, would surely graduate with the recognition that education is not a personal or individual undertaking. They would understand, too, that it is not exclusively about preparing for a job. Rather, they would come to understand that the more education one acquires, the more potential accrues for positively affecting the lives of others. In short, the school district that begins to move its curriculum in these directions is also squarely addressing our society's most profound shortcomings.

There is a way to accomplish this. It starts with teachers and school administrators viewing community well-being as one of their professional obligations. That view changes everything. Unfortunately, such changes will continue to happen only here and there, haphazardly, unless policymakers begin to see the sense and urgency of promoting the value of community—which is one of the original aims of free public education.■

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#### NOTES

1. T. Hine, *The Rise and Fall of the American Teenager* (New York: Bard/Avon Books, 1999).
2. J.B. Conant, *The American High School Today* (New York: McGraw-Hill, 1959).
3. The most preeminent communitarian scholar is Canada's Charles Taylor, but there

are scholars in the United States who have developed reputations almost as distinguished as his. Among them are Robert Bellah, Michael Sandel, Michael Walzer, and Alasdair MacIntyre. Amatai Etzioni and William Galston represent two additional American scholars who have pressed hard to apply communitarian analysis to actual policy decisions. Though no education scholars are typically mentioned as leading communitarian thinkers, certainly the work of individuals such as John Goodlad, TheodoreSizer, and James Comer reflects thoughtful analysis of the role education might play in the cultivation of community. David Orr, Wes Jackson, and Wendell Berry have also written extensively about this idea.

4. Such an emphasis on the future confirms Hine's analysis of high school as an extended period of irrelevance.

5. Our cultural druthers for creating "unencumbered selves"—as Michael Sandel refers to the results of American political theory—are due, in large part, to our peculiar version of what constitutes freedom. Given our birth through separation from Great Britain, we have tended to embrace

negative conceptions of freedom, that is, the idea that freedom really is about the absence of coercive power. There were, and are, other liberal conceptions of freedom, however, that do not result in political theory so singularly focused on the freedom of individuals to acquire what they can. Communitarians tend toward more positive conceptions of what constitutes freedom.

6. J. Dewey, "My Pedagogic Creed," in K. Ryan and J. M. Cooper, eds. *Kaleidoscope: Readings in Education* (Boston: Houghton Mifflin, 1998), p. 280.

7. Moral development theorists are increasingly placing the locus of moral reasoning outside of the self and in the community. Thus, a society that destroys its communities also destroys its ability to evaluate life on a moral basis—hardly the kind of citizenry equipped to wield democratic authority. The philosopher Dale Snauwaert contends that "moral development is by definition intimately connected to community." See D.T. Snauwaert, *Democracy, Education, and Governance: A Developmental Conception* (Albany: State University of New York Press, 1993), p. 60.

8. The best single source primer on constructivist thought related to questions surrounding curriculum and instruction is J.G. Brooks and M.G. Brooks, *The Case for Constructivist Classrooms* (Alexandria, VA: Association for Supervision and Curriculum Development, 1993).

9. R. Miller, ed., *Educational Freedom for a Democratic Society: A Critique of National Goals, Standards, and Curriculum* (Brandon, VT: Resource Center for Redesigning Education, 1995), p. 8.

10. J. Dewey, *Experience and Education* (New York: Macmillan/Collier, 1963), p. 67.

11. Readers interested in learning more about what's going on in Howard should consult the feature story in the November 26, 1997, issue of *Education Week*, pp. 24-28.

12. For more information, see J.L. Puckett, *Foxfire Reconsidered: A Twenty-Year Experiment in Progressive Education* (Urbana, IL: University of Illinois Press, 1989).

13. See K. Curtiss and P. Curtiss, "Learning about Community: What Second Graders Can Teach Us," *Teaching and Change* 5 (2) (Winter 1998), pp. 152-167.

# INSIGHTS

## Interstate II

*A system of high-speed rail lines as part of a larger intermodal network can do for the 21st century what the interstate system did for the last half of the 20th century.*

BY GIL CARMICHAEL

**F**orty-six years ago, America embarked on construction of the Interstate highway system. We built 46,000 miles of multilane routes without stoplights or grade crossings. It was a grand achievement, and it reshaped the face of America.

The Interstate system was not primarily designed for high-speed travel, however. In most states, the top speed limits are only 5 miles an hour above those posted on the conventional federal roadways of the 1950s. Instead, the benefit of the interstates was that they greatly increased the number of cars and trucks our nation's highways could hold while avoiding the stop lights, traffic jams, and slow-downs that had held average speeds to 50 miles an hour or less a generation earlier.

The Interstate system had dramatic impacts upon mobility, economic growth, and transportation efficiency. But its development created problems that we did not consider important at that time. Some urban areas experi-

enced economic growth, spurred by access to modern highway corridors. Others confronted more disruptive consequences. For example, urban interstates became commuter routes, which fragmented downtowns and helped spread residential and commercial development to widely scattered suburbs. Many city centers were devastated, and small towns withered as the new routes took greenfield rights-of-way.

### Air Pollution

Few people worried about air pollution in the 1950s. In one respect, our air had become cleaner because Americans of that era switched from coal furnaces and coal-fired industrial boilers to cleaner units that ran on natural gas or electricity. Meanwhile, our modern highways stimulated the explosion of personal transportation by automobile, instead of public transportation by transit or rail. By the 1970s, vehicle emissions became the primary source of urban pollutants.

For a time, Detroit built smaller cars, but the growth in the

overall numbers of trucks and automobiles soon offset the pollution savings. Local governments chose to pursue industrial polluters instead of confronting the tricky problem of restricting autos and trucks, thereby driving manufacturing out of urban counties.

Today, commuters coming to the city to work in service industries meet outbound commuters headed for factories that have relocated to the urban fringe. City governments are losing the battle against air pollution and have resorted to such strategies as urging residents to avoid running their lawn mowers on high-ozone days or fueling their autos before dark. Yet, most large cities will flunk the new EPA air-quality standards.

### Hidden Costs

Interstates are regarded as safer than conventional highways, but higher vehicle counts, rush-hour traffic jams, and rising driver frustration are degrading the safety performance. Highway fatalities remain at an unaccept-

able rate of more than 40,000-per-year. We would not tolerate this situation in air or rail service.

Only in recent years have transportation engineers and analysts begun to focus on those secondary impacts—such as the costs of pollution, energy waste, land disruption, accidents, and time wasted in traffic jams—that traditionally have been left out of cost analyses. Sometimes these costs—commonly referred to as externalities—are hidden, but they are, nonetheless, real. More to the point, they are not covered by highway user fees. A study conducted for the American Trucking Association concluded that the trucking industry alone was responsible for \$30 billion in annual costs in excess of the user fees it pays. Those costs have been transferred to the general taxpayer, and to the consumer in the form of higher prices. And that's only part of the true cost of these external impacts.

Right now, our highway and airway passenger systems are ailing. Highway and airport gridlock is getting worse, and we have found that we cannot afford to build our way out of this gridlock. Hundred-million-dollar interchanges only move traffic jams to new locations. Highway engineers now recognize, in most cases, that adding lanes to urban interstates won't solve the problem. Congestion just gets worse. Rush-hour in Chicago now lasts eight hours a day. Average speeds in big-city downtowns are slower than they were 100 years ago, and the true cost of operating a new automobile is about 40 cents a mile and rising. If the average car travels 15,000 miles a year, the cost of operating it is about \$6,000 a year. That works out to

500 after-tax dollars per month to move you an average of 1,250 miles.

It has become clear that we cannot solve the transportation needs of the 21st century just by adding ever-more-costly highway lanes. This approach simply is not sustainable; the cost is too high, both in terms of construction costs and adverse impacts on safety, land use, energy consumption, and air quality.

#### Intermodal Systems

What has taken place during the past 20 years is nothing short of revolutionary. Intermodal transportation—the system of moving freight, by trailer or container, between rail, truck, ship, and air—has become the global standard, using a system that is sharply focused on speed, safety, reliable scheduling, and economic efficiency. Today, that network emphasizes moving freight in North America and passengers in Europe and Asia. It is beginning to include passenger service in the United States.

The global high-speed intermodal freight system builds on the strengths of all of the modes working together to provide better service to the customer. It also makes use of the versatility of the cargo container. Cargo ships and airplanes span the oceans. The freight railroad is the high-speed, long-distance, transportation artery on land. The truck provides local feeder service at origins and destinations. Cargo airplanes deliver high-value, specialized freight. This system works, but it urgently needs dramatic improvements to its land component in order to handle the growing volumes of containers delivered by ship and airplane.

Modern, high-efficiency, high-capacity intermodal terminals are key to the system, providing an almost seamless interchange. Secondary rail and highway routes support the intermodal system and connect cities, rural regions, and individual freight customers to the main-line corridors.

Today, a doublestack train leaving a coastal port replaces 280 trucks, runs at speeds up to 90 miles an hour on the western railroads, and affords as much as nine times the fuel efficiency of container transport by highway. Overall, the operational and economic efficiency of freight's intermodal network conserves fuel, reduces other environmental impacts, and is significantly safer. It represents the most economically and environmentally sustainable approach to transportation services.

Meanwhile, this new intermodal science is redrawing the railroad map of North America, linking the populations and economies of the United States, Canada, and Mexico in a true North American rail system. Our continental network serves 400 million people in 90 states and provinces with 240,000 miles of routes. Most of its main lines are in excellent shape. Over \$60 billion in private funds have been spent for upgrading to heavy-duty welded rail.

#### A New Vision

One could make the case that the worst defect of our passenger transportation system is the limited number of choices it offers. Residents of cities with populations under 100,000 often have only one practical option for intercity travel: the private automobile. Where bus and Amtrak

services exist, they often are insufficient to meet the customer's needs. Airlines have retreated from short-haul markets. Where air service remains, the fare levels have driven people back to their automobiles.

It seems that our success in freight intermodal transportation points the way to the most promising strategy for transportation improvements in the years ahead: Interstate II, a new vision of truly high-speed intercity travel that depends on steel, not pavement, while taking advantage of and expanding on the existing intermodal system. The concept is not radical. It combines the proven efficiency of rail transportation with the strengths of the intermodal system. Interstate II can take advantage of rights-of-way that already exist—both rail and highway.

Interstate II is already underway. The New York-Washington Northeast Corridor has been in place since the 1970s. High-speed trains will serve Boston later this year. Turbo trains now operate on the Empire Corridor in New York state. Washington, Oregon, and British Columbia are developing a high-speed route in the Pacific Northwest. Eight years ago Congress authorized five new high-speed rail corridors. Today, with the Transportation Equity Act of the 21st Century, 13 corridors have been approved for development.

When Congress voted \$2.3 billion in capital funds for Amtrak, it sent a message that intercity rail passenger service is here to stay. It is interesting to note that Amtrak's package-express business is booming as well, because express companies cannot expand if they are limited

to clogged highways. Interstate II will attract mail and package-express business away from highways and airways—adding to the new system's revenues, and helping to share the increased traffic loads that the other modes confront.

The conditions setting the stage for Interstate II are similar to the conditions that prevailed during the 1950s. The old two-lane roads were not adequate for traffic volumes. Several states—Pennsylvania, New Jersey, New York, Ohio, Indiana, Illinois, Kansas, and Oklahoma—took the lead in building toll roads. Important segments of the first Interstate system were already in operation before Congress voted to launch that project.

The same thing is happening in the 1990s. These state and regional initiatives represent the beginning of a network of high-speed rail lines. Many of them will parallel Interstate highways. During the first quarter of the 21st century, we can build about 20,000 miles of corridors capable of running trains at 90 to 150 miles per hour. That network will be augmented by as much as another 10,000 miles of high-quality conventional rail routings.

Often, we will be able to use the same right of way that freight railroads now occupy if we deal with a number of key issues including grade separation and liability. Reducing the number of highway-rail crossings will be especially critical. Many crossings can be closed because they are unnecessary. Others will require building overpasses. The remainder can be fitted with high-tech crossing devices. We cannot have efficient rail corridors—conventional or high-speed—if trains

encounter grade crossings every mile in the country and every block in town. Some people will shy away from the crossing-closure issue as too controversial. But think back to the 1950s. We closed tens of thousands of road intersections when the Interstate highways were built.

#### Intermodal Expansion

For Interstate II to function properly as part of a vast intermodal network, we must create terminals to transfer passengers and freight among modes and routes. Fast, modern, and highly efficient intermodal terminals and yards are essential to freight's intermodal system, helping provide seamless service. Get off an airplane at Dulles or Denver airports and you are reminded that seamless service hasn't arrived. The seams are ripped apart just on the other side of baggage claim.

City center terminals will be especially important. The city center terminal serves the intermodal passenger network. It also serves cities both large and small and helps to revitalize the downtown. These facilities should be developed by local government, just as they built and financed airports. City center terminals can be hubs for people and retailing. In larger cities, they can provide a financial contribution to the overall corridor development project.

Amtrak will have a key role in the intercity passenger component of Interstate II. But we need to start thinking about Amtrak in a more realistic context. Amtrak should be in the business of moving people intermodally—in partnership with intercity bus companies and local transit—but not owning track or terminals.

Amtrak should operate and be treated like an airline. Airlines don't build airports. They don't carry those debt costs on their books. If airlines had been compelled to finance airports, they would not have had the capability to undertake the remarkable expansion of fleets and service that has occurred during the past 40 years. What's fair for airlines ought to be fair for Amtrak, which today is burdened with aging station facilities that in many cases are an embarrassment that discourages use.

#### Who Pays?

Interstate II is an option we can afford. For the equivalent of two cents on the motor fuel tax—one penny at the federal level and a second from the states—America could have, within 20 years, a network of high-speed rail corridors that approaches the scale of the Interstate highway system. But it would be better than the Interstate system because it would be part of a larger intermodal system that includes the Interstate system as well.

Such a commitment of fuel tax dollars would offer a powerful incentive to additional private investment. States and cities would become partners in the process, bringing still more revenues to the table.

Some people will argue that motor fuel taxes should go only to highway projects. But highway construction is not solving the gridlock problem. The existing level of highway user fees doesn't even come close to covering the costs that highway transportation now inflicts upon our economy and society. More to the point, these fees are not building the system we need, one that captures

the safety and capacity of the 21st-century intermodal passenger and freight network.

Cities, towns, counties, and citizens already are paying for that funding gap in many indirect ways. They are paying for the additional law enforcement and emergency services costs that highway transportation generates. They are losing income when land lost to highway rights-of-way goes off the tax rolls. And they are losing much more when pollution regulations drive industrial jobs out of urban counties even though most of the emissions are highway-related.

#### Other Alternatives

Aside from the obvious benefits from Interstate II, we don't have other genuine alternatives. If trends of the 1980s and 1990s persist into the new century—and there is no reason to believe they won't—conventional solutions based on individual modes simply cannot cope with the growth. Does anyone seriously believe we can double the capacity of our urban highway system within the next 15 years? The price tag for just a 10-percent increase would be staggering. And does anyone think we will add eight or nine airports on the scale of Denver International?

We are long overdue in coming to grips with the huge costs of trying to make the highways and airways solve all our transportation needs, especially since there is an efficient alternative. The American people and their leaders need to understand that Interstate II is possible; it is the obvious solution to our mobility needs for a new century. Rail corridors will prove to be cheaper than \$100 million interchanges that only

relocate traffic jams, and they will be safer than America's roadways, which cause 43,000 deaths a year.

This new, ethical intermodal transportation system will conserve fuel, reduce pollution, and be less disruptive in land use. And just as America's toll roads used private money to finance construction, Interstate II can attract major private investment cost-sharing. Private money can be applied to construction, operations, station development, and equipment.

How many times have you heard people ask, "Why can't we have trains like those in Europe?" The answer of course is, we can. It's a question of priorities, strategy, partnerships, leadership, and policy.

Americans can have a customer-driven passenger system. They can have a choice within that system; they don't always have to pay 40 cents a mile to go somewhere. Americans can obtain a highly efficient, low-cost freight and express network that will reap even more benefits through its intermodal design. Americans can have interstates of steel for less cost than interstates of concrete and asphalt. And Interstate II will provide plenty of work for the traditional highway builders.

Building this safe, 20,000-mile, high-speed, intercity rail network can guarantee quality transportation service during the next century. The money is there and we can do the job. We just have to get started.■

*Gil Carmichael, who is vice-chairman of MotivePower Industries Inc. and chairman of the Amtrak Reform Council, lives in Meridian, Mississippi. He was President Bush's Federal Railroad Administrator.*

# BOOKS

## Rockin' across the USA

BY JOSHUA A. CHAMOT

John McPhee has achieved icon status in the geosciences community, and for an English major that is no small feat. His latest venture into popular nonfiction, *Annals of the Former World*, is a compilation of five books on the geologic history of the United States. In digestible essays, McPhee takes several of the core, and at times controversial, subjects in geology and presents them with enough detail to educate and enough color to entertain.

*Annals* was inspired by McPhee's year-long, roadside geology excursion of 1978. Traveling along Interstate 80, he took five separate trips through as many different geologic domains, each in the company of a regional expert. When McPhee recognized that his trips would keep him writing for more years than he wanted to spend on the subject in one stretch, he broke the work into four books to be published over the next two decades.

In the first, *Basin and Range* (1981), McPhee follows Princeton geologist Kenneth Deffeyes as Deffeyes looks for economic silver deposits in

Nevada. McPhee presents the geology of the violently rifted western United States while introducing two of *Annals'* recurring themes: mineral exploration and plate tectonics, the theory that the Earth's crust is made up of moving plates. In these discussions, McPhee translates the grand scale of miles of rock and millions of years into the relatively small confines of human perception: "People like to think in five generations—two ahead, two behind—with heavy concentration on the one in the middle."

The second book, *In Suspect Terrain* (1983), profiles pioneering geologist and Brooklyn native Anita Harris. In this work, the wide range of topics at times seems disjointed. However, the focus remains on Harris and how her work on tiny conodont fossils—ubiquitous markers for oil and gas formation—helped to revolutionize petroleum exploration. Harris also plays a significant role in the discussion of plate tectonics that permeates *Annals*. She is an esteemed geologist who is reluctant to



endorse all applications of plate tectonic theory, particularly when plate tectonics allow for overly simplistic answers to complex questions. McPhee presents her as a cautious, and therefore vital, voice in this scientific debate.

In *Rising from the Plains* (1986), McPhee explores the diverse geology of Wyoming while simultaneously recalling the frontier upbringing of geologist David Love. As McPhee tells it, David Love was born and bred into Wyoming geology and his youth was nothing short of a western epic. Love's parents raised their children on an isolated farm miles from any sort of town, and visitors included some of the leading geologists, and even outlaws, of the West. In this book, McPhee also confronts the internal conflict that Love and other environmentally conscious geologists may face when they search for natural resources. These scientists know that their work may lead to the destruction of the same landscapes that lured them to geoscience careers. McPhee considers David Love an "exploration

geologist and passionate defender of wild Wyoming,” who embodies this struggle, which continues to breed conflict within the geologic community.

The geoscientist featured in *Assembling California* (1993) is Eldridge Moores of the University of California-Davis, one of the giants in plate tectonic theory. Through travels spanning from the Napa Valley to the war-torn island of Cyprus, McPhee explores the complex geologic history of California and the growing evidence for plate motion. In substantial asides, McPhee delves into the history of the California gold rush and the history of California earthquakes. His portrayal of the

Loma Prieta quake that struck the San Francisco Bay area in 1989 is particularly vivid and is enhanced by the stories of individual victims.

The final book, *Crossing the Craton*, is the only section comprised of all new material. This discussion of the deceptively stable continental interior completes the work McPhee began in 1978. Beneath the midsection of North America lies an extinct rift zone, similar in form to the active one tearing apart western Africa. W. Randall Van Schmus of the University of Kansas is McPhee’s host in this exploration of the oldest rocks on the continent—and in the world.

*Annals of the Former World* is a

nongeologist’s guide to the geologic perspective. John McPhee deftly carves complex subjects into perceptible, guided essays. While some topics may at times be confusing to those who have little geologic background, McPhee peppers his work with enough analogy, imagery, and historical insight to interest a diverse audience.■

John A. McPhee, *Annals of the Former World* (New York: Farrar, Straus and Giroux, 1998); 660 pp., index; cloth, \$35.

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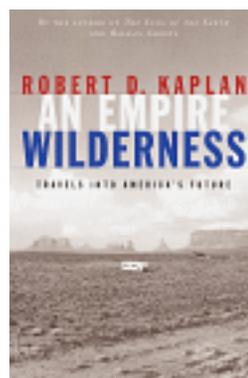
## Decline of the West

BY THOMAS D. ROWLEY

**B**ummer. John Philip Sousa tunes no longer tingle the spine. The nation’s government is good only for defense. And the country’s only borders stand between the haves in their gated communities, and the have-nots staring wistfully, if not criminally, over the fences at the coveted homes. Such is the future Robert D. Kaplan paints in *An Empire Wilderness: Travels into America’s Future*. And while I’m not sure I buy the forecast in its entirety, portions of his vision are hard to deny. In fact, they

already exist.

In the preface to this futuristic travelogue, Kaplan says his goal was to integrate the disparate issues of “the military, urban transformation, the Mexican border area, race relations, the environment, and so on.” To that list, I would add “and on and on and on,” for Kaplan is indeed ambitious in his reach, taking multiple side paths that, while interesting, do little to advance his central thesis that the nation



as we understand it is disintegrating.

To illustrate his thesis, Kaplan leads us on a meandering tour of points west. His stops include military bases, cities, towns, Indian reservations, national parks, and civil war battlefields in 14 states, Mexico, and Canada. Kaplan believes it is in the West—which for him begins at St. Louis—that America’s transformation is most apparent.

For Kaplan, the transforma-

tion is principally in the rise of city-states, or what he prefers to call post-urban pods. In these pods, the upper and middle classes do business amongst themselves and with others of their kind around the globe. Their allegiance is to the global economy and the omnipotent dollar rather than the region or nation. This disconnect from the lower classes around them leads, historically and predictably, to disturbing consequences. First, are the racial and economic enclaves that divvy up so many of our urban areas—St. Louis and East St. Louis; Kansas City, Overland Park, and Johnson County; and North Omaha and West Omaha. Second, is the bland sameness that makes one pod look like the next.

Instead of reflecting a unique culture, each future city seems likely to consist of the same borrowed fragments: standardized corporate fortresses, privately guarded housing developments, disneyfied tourist bubbles, restaurants serving the same eclectic food, and so on.

There is little to dispute in Kaplan's perspective on these pods. Indeed, other writers such as Neal Peirce, Joel Kotkin, and Rosabeth Moss Kanter have noted the rise of the global class and city-states. Nevertheless, I would have preferred more analysis of the causes and less, rather repetitive, description of the consequences.

Also lacking is an account of the efforts to deal with forces of change. Kaplan only briefly mentions a few folks out in the trenches who are fighting this

post-apocalyptic vision. This lacuna in the otherwise accurate narrative creates something of a black hole that begs for light.

The darkest shadow Kaplan casts, hangs over the future of the nation—both as governmental unit and a source of personal or communal identity.

In many ways, Kaplan is correct: the importance of the United States is declining. With all due respect to Mr. Greenspan, the *national economy* is no longer a useful construct. Rather, the national economy comprises myriad local and regional economies with their own specialties, labor markets, and infrastructures, each buying their inputs and selling their outputs around the world. These smaller economic units buy and sell around the world.

Likewise, governmental devolution has moved many functions and responsibilities—welfare, for example—out of Washington to the state level, while international trade agreements have, in some cases, superseded national policy. Kaplan sees these trends—combined with technology, immigration, and good old-fashioned greed—as the potential death knell of nationhood. Other than defense, what common cause will one pod have with another?

Still, I think last rites are premature. Bureaucracies die hard, and billions of dollars flow out of Washington to buy voter loyalty—even out West. Remember the Federal Agriculture Improvement and Reform Act of 1996 that would reduce price supports and move farmers back into the market? How many billions of federal dollars were

transferred to the farm belt to bail them out when things went bad?

And what about the millions of acres of federal land that are lying out there—are they ripe for the plucking? During the Sagebrush Rebellions of the 1970s and late 1980s, western states failed to turn over federal lands to state and local control. I doubt the powerful post-urban pods will fare any better in grabbing the reins from the Forest Service, the Park Service, or the Bureau of Land Management.

And what about interstate highways, or environmental regulations, or...well, you get the picture. The federal government, like it or not, is here to stay.

Of course, Kaplan's point is not limited to the demise of our national government. He poignantly portrays a threat to our identity as people of a common nation with a common allegiance. And here, sadly, who can say?

In answer to a woman who asked what his book was about, Kaplan said it was about whether Americans 50 years from now would still be moved when they heard a Sousa march on Inauguration Day. She replied that she couldn't imagine anyone feeling such an emotion even today. Now that sends a shudder down my spine.■

Robert D. Kaplan, *An Empire Wilderness: Travels into America's Future* (New York: Random House, 1998); 393 pp.; cloth, \$27.50.

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# Urban Husbandry

BY DENNIS MCCARTHY

One of the defining trends of the last half of the 20th century was the collapse of America's cities. For those of us who love cities and see suburbia as the death of culture, this trend has had apocalyptic overtones. Fortunately, however, after decades of white flight, poor planning, misspent policies, and urban neglect, our nation's cities—some of them, at least—are coming back to life. How and why is not always clear, which makes replicating the successes difficult. Nonetheless, urban recovery is happening, and that in itself is cause for celebration.

Worrying about the fate of cities has become big business if the spate of new books on the topic is any indication. Recently, I conducted a totally unscientific survey—I checked Amazon.com's listings of related books its customers are buying—and discovered no fewer than a score of new books on the topic.

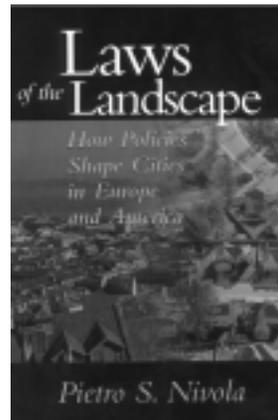
One of them was Pietro Nivola's *Laws of the Landscape: How Policies Shape Cities in Europe and America*. Unlike some of the other recent books that are compendia of urban success stories—long on anecdotes and short on analysis—Nivola tells us how we got into the current mess. He explains why solutions have worked in some cities but not others, and he offers sugges-

tions for getting around the unforeseen follies that past policies have produced.

Nivola examines European and American cities and finds numerous examples of policies that have helped prevent European cities from suffering the same fate that has befallen the United States. For instance, the average price of gasoline is two and a half to three times higher in Europe than in the United States. Expensive gas discourages Europeans from moving to the suburbs, especially when their jobs are downtown. And their jobs are downtown, at least in part, because strictly enforced land-use laws control development in the urban fringe.

Nivola, of course, is not suggesting that European urban policies are panaceas for America. For one thing, these policies don't easily transfer to the United States. For instance, how do we undo the federal highway system, which has been a major contributor to urban sprawl? The answer, of course, is we can't.

The U.S. investment in highways is staggering compared to other countries. Our overall per capita transportation budget is unparalleled, as is the percent-



age of that budget that goes to highways. In 1993, for instance, the British invested 30 percent of their transportation budget in highways—the rest went to passenger trains and mass transit—while the United States put 86 percent of its trans-

portation funds into highways.

Since we can't undo earlier policies, the real question is, where do we go from here? One possibility is to develop new policies that undo the harm caused by earlier policies. Nivola likes this approach. For example, inner-city housing projects for impoverished residents in many cases have created breeding grounds for crime. Nivola proposes that these projects, where possible, be converted into mixed-income residences, that the government expand rental vouchers, which allow the urban poor to move to better neighborhoods, and that we stop making it so easy for parents to desert their families.

The problem, of course, is that if government-mandated, well-meaning policies misled us the first time, how much confidence can we place in replacement policies that look good on paper but that may well produce their own unforeseen, unintended, and untoward conse-

quences? It's too early to tell, for instance, whether enterprise and empowerment zones—the latest revitalization tools—will work where urban renewal failed. We borrowed the zone idea from the British, where it had little impact. Maybe it will work here, maybe not.

Nivola provides another useful service by poking holes in some of our assumptions about the costs of sprawl and urban renewal. It's commonly assumed, for example, that it's cheaper to revitalize a community than to build a new one. Anyone who has tried to renovate a house recognizes the fallacy in this assumption. Moreover, Nivola points out that many communities charge developers special fees for new construction, which go a long way toward offsetting infrastructure costs. Of course, developers pass along the charges to buyers, but at least the infrastructure is paid for by buyers rather than taxpayers. And for the buyer, the money spent is more of an investment than a tax.

Nivola also argues that the

alternatives to, say, a sprawling Phoenix is not a Paris or Florence but a taller, denser Phoenix. And a taller, denser Phoenix, he says, probably won't better serve the environment, and it will drive up prices for the poor. Sure, the water supply would last a little longer if fewer suburbanites were watering their lawns, but the reality is that demand for water would continue unabated so long as supply was adequate. Right?

Well, not necessarily. The point Nivola seems to miss is that not all the costs of sprawl can be easily quantifiable in economic terms. The losses of landscape, biodiversity, and clean flowing streams don't fit easily into a cost/benefit analysis. Nor do crippling traffic snarls, hour-long commutes, and loss of community life. These are real costs, and someone somewhere eventually will pay for them, whether it's through higher medical expenses or lost opportunities or poorer quality of life.

If you need an example, look no further than the horripilating costs of hurricanes Floyd and Dennis this past summer.

Setting aside the question whether past industrial activities contributed to the intensity of recent hurricane seasons, we wouldn't be rebuilding now if we hadn't allowed so much development to take place in areas totally unsuited for it. Of course, the rebuilding that's currently going on along the Carolina coast will have to be redone when the next disaster strikes. And you and I will pick up the tab, through insurance premiums or taxes or both.

*Laws of the Landscape* is a good book. It's intelligent, thought-provoking, and well-written. If you love cities, this book deserves your attention. Buy it and read it. You'll not regret it.■

Pietro S. Nivola, *Laws of the Landscape: How Policies Shape Cities in Europe and America* (Washington, DC: Brookings Institution, 1999); 126 pp.; paper, \$14.95.

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# Unusual Suspects

BY PHIL BROWN

A growing body of knowledge has linked many diseases and abnormalities to endocrine disruptors in chemicals that are pervasive in our society. This hypothesis, which is unfolding before us, is widely discussed in scientific, media, and government circles, and will likely shape the ways our whole world thinks about chemicals and disease for years to come.

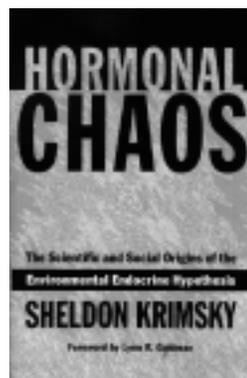
How often does the lay public get an opportunity to watch a scientific hypothesis unfold? And if we do get that opportunity, how likely is it that we will understand what is transpiring? With the endocrine disruptor hypothesis, we have the chance to witness such science in action, and by reading Sheldon Krimsky's *Hormonal Chaos*, we get a terrific analysis of the scientific and policy background and a roadmap to the future.

Krimsky details three scientific paths that have been unified in a working hypothesis by Theo Colborne, co-author of *Our Stolen Future*, and other researchers. First came the discovery in the 1970s that a drug given to pregnant and postmenopausal women, DES, was responsible for causing vaginal cancer and other diseases in those women's children. Around the same time, researchers were finding many reproductive disorders in wildlife

exposed to certain chemicals in the environment, and others were also finding a global decline in quality and quantity of human sperm.

Krimsky tells in fine detail the mechanisms by which scientists recruit scientists and others to their perspective through what he terms the construction of a science constituency. Theo Colborne, the star of this story, found others engaged in similar interdisciplinary research and involved them in the now-famous Wingspread Conference, held in 1991 in Racine, Wisconsin, to examine this new hypothesis. The Consensus Statement that resulted was the first detailed formulation of the hypothesis; it organized a baseline of knowledge, urged testing programs for chemicals, and recommended greater environmental regulation. The power of this conference and the disturbing nature of the events leading up to it were sufficient to generate a U.S. Senate committee to study reproductive problems just a few months later.

Yet controversy leapt around the endocrine disruptor hypothesis. Some researchers found instances where effects were absent, while others argued that natural substances also had estrogenic qualities; hence we



should not blame industry. Krimsky presents the opposition's objections to the hypothesis, but he also points out the pro-industry bias of many researchers, some of whom receive funding from the chemical industry for their research.

Another conference held in 1995 at Erice, Italy, led to a new consensus statement and further solidification of the endocrine disruptor hypothesis—now growing to include neurological effects in humans—and drew more interest from other scientists. Between the 1991 Wingspread conference and the 1996 publication of *Our Stolen Future*, Colborne cultivated a science constituency that advanced scientific understanding of the endocrine disruptor hypothesis and put it before a huge audience.

As a pioneer and visionary, Colborne has been widely compared to Rachel Carson, whose 1962 book *Silent Spring* was seminal in the environmental movement. That is a very honorable comparison, and though it will take a long time to know if it is apt, there are important similarities between these two women. Like Carson,

Colborne had a holistic vision, which crossed boundaries into other areas of science and helped create linkages that were invisible to others.

In addition to explaining the construction of a scientific constituency, Krimsky offers his creative concept of a public hypothesis in which the development, elaboration, and attempts at confirmation of the hypothesis are done in the public limelight with many public actors, including social movements, in addition to the usual complement of science and government.

Scientific journals, however, were not receptive to the hypothesis, and rejected many articles on the topic. Curiously, only the National Institute of Environmental Health Sciences's *Environmental Health Perspectives* published a significant number of articles on the endocrine disruptor hypothesis.

Instead, public participation grew because of widespread media and public interest in the mid 1990s, interest on the part of the U.S. Environmental Protection Agency, the work of breast cancer activists, a 1994 BBC documentary on declining sperm counts, the publication of *Our Stolen Future*, and the awareness generated by an ongoing National Academy of Sciences panel. It is clear that many nonscientific factors play a role in the development of science, and Krimsky does an excellent job of analyzing this aspect of scientific progress.

Other countries acted as well, often with rapid removal of substances thought to be endocrine disruptors. The swift action of government, science, and

nongovernmental organizations was amazing. "The explosive growth of this issue within such a short time without a signature event or definitive evidence of human illness is quite unusual in modern environmental history," Krimsky writes. Nevertheless, professional societies have been slow to respond, and not surprisingly, the chemical industry has spent much money and effort to combat the hypothesis, including establishing new organizations, such as the Chlorine Chemistry Council, that attempt to sell the public on the safety of plastics and chemicals.

Krimsky clearly leans toward accepting the endocrine disruptor hypothesis, but he makes it clear that there is as yet no certainty, and he also points out the conflicting perspective of opposing actors.

Many public interest groups, already organized against persistent organic pollutants, incorporated the endocrine disruptor imagery and research findings to reinforce their existing agendas. Industry, on the other hand, began emphasizing the importance of "good science," citing uncertainty, the ambiguity of results, confounding variables, and the need for more research.

Indeed, Krimsky points to situations where risks were much more dangerous than were the warnings of those risks—lead and asbestos, for example—and others where warnings are more dire than actual dangers, such as electromagnetic fields. Advances are often stopped by counter-evidence, and the path of alternative hypotheses is a rocky one.

A chapter on "Uncertainty, Values, and Scientific Responsi-

bility" provides excellent analysis of the conservatism of traditional science, especially when confronted with wide-ranging and holistic approaches and when faced with challenges to long-standing canons such as linear, monotonic dose-response relationships, the traditional model for toxicologists who believe the greater the dose, the greater the effect of toxic substances. This view of toxicological risk is currently being challenged by researchers who are finding that, because of the complexity of the endocrine system, even minuscule doses may cause major disruptions.

Scientists' social and moral responsibility in such situations depends on how they view their role in science, how they view the role of values in sciences, and how they view the role of science in society. Are scientists responsible for bringing elevated disease rates to the attention of the public? Should they release research findings or unanalysed data before publication of their results in peer-reviewed journals? Should scientists use the precautionary principle to make it harder to bring new chemicals to market or to implement new uses of existing chemicals, rather than simply let industry and science do as they wish without adequate regard to possible hazards?

Ultimately, Krimsky tells us, "Even the strongest proponents of the hypothesis are cautious about making causal claims that link exposure to endocrine disruptors (as determined by animal or in vitro assays) to human health effects."

Even if the endocrine disruptor hypothesis is not

confirmed, the widespread chemical testing it engendered will surely be of great benefit in terms of detecting other health effects and other pathways. Whatever the outcome, the debate has had a huge impact on toxicology and epidemiology and has cast its stamp on public policymaking.

Krimsky is one of the country's most intelligent and

creative analysts of scientific controversies and of the social responsibility of scientists. He writes in an engaging manner and very readable style about a subject that will have dramatic impact on our lives. This is the kind of contribution that best demonstrates how social scientists as well as socially inclined natural scientists can present complex material to the public

in an accessible fashion.■

Sheldon Krimsky, *Hormonal Chaos: The Scientific and Social Origins of the Environmental Endocrine Hypothesis* (Baltimore: Johns Hopkins University Press, 2000); 282 pp.; cloth, \$35.95.

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# Justice for All

BY KENNETH L. MOSSMAN

**H**uman subjects are protected from research risks by federal regulations. In 1947, the Nuremberg Code, a document that emerged from the Nuremberg Trials of Nazi war criminals, formally established ethical standards for biomedical research involving human subjects. Despite U.S. participation in the development and implementation of the Nuremberg Code, the nation lacked a consistent and coherent policy for protecting human subjects from research risks until the establishment of the federal Common Rule in 1991.

The Common Rule created regulations applicable to all federal agencies and departments concerning human subjects in research settings. The emphasis of these regulations has been on protecting individual subjects

from research risks. The importance of appropriate representation of specific populations such as women and minorities in research studies has received less attention.

*Beyond Consent: Seeking Justice in Research*—edited by Jeffrey Kahn, Anna Mastroianni and Jeremy Sugarman—explores the concept of justice and its application to research with human subjects. The concept of justice goes beyond traditional concerns for protection of human subjects by including the need for making good and fair decisions about the selection of subjects.

The editors, who served on the President's Advisory Committee on Human Radiation Experiments, have assembled an outstanding group of contributors and authored two chapters of their own, including the introduction and an overview of

policies on the use of human research subjects.

*Beyond Consent* provides an excellent historical overview of specific cases that failed to protect human subjects, such as the notorious Tuskegee Syphilis Study. The book also examines the concept of justice and the difficulty of applying that concept to research with human subjects, termed *the vulnerable sick*, who may be desperate for new cures—HIV-positive patients and patients with cancer, for example—and other specific research populations such as children, women, minorities, prisoners, and other institutionalized subjects for whom informed consent may be problematic, if not impossible to obtain.

The final chapters explore theories of justice in the context of human research and examine the importance of properly

balancing protection of individual research subjects with the need to implement justice in future research. The authors close by suggesting ways policy on research protocols can ensure justice in research on human subjects through fostering the subjects' trust as well as recognizing their dignity as human beings and paying attention to their concerns.

While the editors do a fine job in framing the discussion on justice in human research conducted under federal guidelines, *Beyond Consent* does not broach the serious problem of the conduct and design of research projects in privately financed studies. Institutions not receiving federal support are not subject to federal regulations

that ensure informed consent, protection from research risks, and justice. The Human Research Subject Protection Act of 1997, had it been enacted into law, would have required that all human-subjects research be governed by federal regulations. Critics of the bill successfully argued that there is no evidence that the absence of regulation had caused significant harm to large numbers of people.

*Beyond Consent* is also somewhat limited in scope as it focuses primarily on the United States, which has the most comprehensive regulatory framework of protections of subjects from research risks. A chapter comparing other national approaches to justice in human research settings would

have been informative.

This well-written, in-depth analysis of issues of justice in human research should be a valuable resource to scientists and physicians responsible for the design and conduct of human-subjects-research studies, bioethicists, institutional review board members, public health officials, regulators, and policymakers.■

Jeffrey P. Kahn, Anna C. Mastroianni, and Jeremy Sugarman, eds., *Beyond Consent: Seeking Justice in Research* (New York: Oxford University Press, 1998); 190 pp.; cloth, \$ 39.95.

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# Greedy Giants

BY THOMAS CHEN

Pulitzer finalist Dan Fagin and Polk Award recipient Marianne Lavelle's tale of corporate greed is guaranteed to raise your blood pressure, much like insider stories detailing how tobacco giants manipulate Americans. The only difference is that domestic outcry has forced tobacco companies to move their production and marketing abroad, while the chemical industry continues to manhandle every sector of society and make profits at the expense of Americans' lives.

*Toxic Deception*—by Dan Fagin, Marianne Lavelle, and the Center for Public Policy—meticulously documents the boardroom strategies used by chemical manufacturers to crush every obstacle to corporate profit. The question is whether this culture of greed is pervasive throughout all corporate culture, or is the chemical manufacturing industry an exception to the rule? As we learn more about



sweatshop industries, pharmaceutical companies driving up the price of prescription drugs, and the maneuverings of the health maintenance organizations, we have to wonder.

Even more alarming, as we race headlong into the Century of Biotechnology, we are on our way to repeating history; only now the culprit is going to be biologics instead of chemicals. Virtually

all the chemical giants mentioned in this book have invested heavily to grab their fair share of the exploding and lucrative biotech frontier. Potential problems associated with genetically modified food and recent questions about safety compliances in experimental gene therapy, the authors note, are only the tip of the iceberg.

*Toxic Deception* focuses on the carcinogenic characteristics of only four chemicals out of more than 84,000 chemical substances currently on the market. Since many of these chemicals cause developmental abnormalities and hormone disruption, there is great cause for concern about the gravity of the problem.

The authors describe the dirty tactics chemical manufacturers engage in—including influence peddling, victim silencing, courtroom delays, and whistleblowing—under the guise of stimulating the economy rather than simply driving their own profits. Fagin and Lavelle have methodically investigated and documented these corporate tactics in hopes of mobilizing support for fundamental regulatory reforms. As they make clear, corporate giants make all the calls since the budget-strapped U.S. Environmental Protection Agency relies on industry research on the safety of these chemicals rather than conducting its own studies or farming out the work to independent researchers.

There are two ways to determine the hazards of any given chemical. Currently, industry advocates mechanistic studies, which seek to determine whether a chemical activates or suppresses cancer-related genes. This, the

authors note, is a kind of delay tactic designed to avoid investing in toxicological studies, which yield faster results and quicker bans on toxic chemicals. While mechanistic investigations may ultimately solve the seemingly insurmountable task of identifying and classifying toxic chemicals, toxicological studies must proceed with full speed before irreversible damages are done to us and our environment.

With the near-completion of the Human Genome Project, we are on the verge of developing powerful diagnostic tools to unequivocally identify carcinogenic compounds. The chemical industry, knowing the implications, has already positioned itself for the next round of battles.

A minor weakness of *Toxic Deception* is that a very small number of the studies cited either came from journals that are not rigorously peer-reviewed or were too old to be reliable, based on current standards. In addition, the authors referred to a highly publicized study by toxicologists at Xavier University, suggesting that exposures to two or more chemicals could exacerbate their toxic effect hundreds of times more than if they acted alone. However, the paper in question was withdrawn well before the publication of *Toxic Deception* because other investigators could not reproduce their results. Finally, the statement that cancer will surpass cardiovascular disease as the number one killer in this country probably will not become a reality in the foreseeable future.

If the hands of the EPA—the government agency established for the sole purpose of protecting the general public and our

environment—are tied by industry, its accomplices, administration officials making sweetheart deals with the chemical industry, and an unsympathetic Congress, how can the ruthless corporations with their vast resources be tamed? Will the general public have to depend on investigative journalists, public policy advocates, or the courts to fight for environmental justice? Or is it left to the common folks most profoundly affected by unscrupulous industrial giants? The prospect does not look promising, as a simple campaign reform to limit corporate influence cannot pass the current Congress.

The last chapters of the book attempt to address the costs of toxic deception. This section would have been more informative had it presented a credible estimate of direct and indirect costs to our economy with respect to mortality, morbidity, and other intangible damages from toxic deception, assuming such data exist. Nevertheless, the book is a wakeup call for everyone concerned about their own health and welfare and that of their grandchildren.■

Dan Fagin, Marianne Lavelle, and the Center for Public Integrity, *Toxic Deception: How the Chemical Industry Manipulates Science, Bends the Law, and Endangers Your Health* (Monroe, ME: Common Courage Press, 1999); 280 pp; cloth, \$29.95; paper, \$17.95.

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# Compromised Immunity

BY CARL BRUCH

Three principles are essential to sound environmental governance: transparency, participation, and accountability. Nowhere are these principles so important—or difficult to realize—as in addressing the environmental consequences of the manufacturing, testing, and use of nuclear weapons.

*Critical Masses* examines how citizens and nongovernmental organizations in the United States and Russia have used these principles to compel their respective governments to account for the environmental devastation caused by the production of nuclear weapons. This book, written by a team of authors with backgrounds in political science and social ecology, compares the citizen movements that arose in response to the environmental and public health catastrophes at two facilities producing weapons-grade plutonium. The Hanford Reservation in the state of Washington and the Mayak Complex in the Chelyabinsk-Oblast region of Russia were key players in the U.S. and Russian weapons programs. In both cases, the immediate and long-term impacts have been devastating. And in both cases, governments withheld information in the name of national security.

In 1949, for example, officials

at Hanford attempted to simulate production processes at Mayak and intentionally released into the atmosphere thousands of curies that contaminated surrounding communities and farms. Over the course of four decades, plant operators negligently and accidentally released more than 100 million curies to the air, water, and soil. Yet it was not until the late 1980s that citizens near the Hanford site invoked the Freedom of Information Act to force the U.S. Department of Energy to open its records to the public.

At the same time, similar events were occurring in Russia. In 1957, for example, an explosion at Mayak released 20 million curies of radiation into the atmosphere, and over the years, the facility released hundreds of millions of curies through negligence and accidents. By comparison, the high-profile 1978 Three Mile Island accident released 14 curies.

In the 1980s, citizen movements in both countries, countering claims that the information was a matter of national security, compelled the governments to open up their records and include the public in the decision-making processes of remediation. Despite the vastly different political systems, sociocultural values, and re-



sources available, these movements bore remarkable similarities. In both cases, citizens were able to obtain information about the releases and impacts in the face of strong government

resistance, limited financial resources, and a public that often had an economic stake in the installation's continuing operation.

*Critical Masses* uses a broad array of tools, including historical accounts, interviews, surveys, and legal analysis to track the evolution of the movements, the perceptions held by citizens and environmental leaders, and the response of the two countries. This book is more than just a history of environmental movements, however. A January 29, 2000, article in the *New York Times* reports that the U.S. Department of Energy has recently owned up to many of the public health effects of the U.S. nuclear weapons program.

Additionally, *Critical Masses* explores fundamental questions about the role that particular ideologies, political systems, and resources play in environmental governance.

These issues will provide fertile ground for discussion for many years to come. For example, do the principles of environmental governance of

fundamental human rights have universal application to all political, social, and economic systems? Increasingly, regional and global instruments answer in the affirmative.

Principle 10 of the 1992 Rio Declaration, while not carrying the legal weight of a binding international convention, laid the groundwork for such a principle. Governments and citizens groups around the world are currently developing and implementing initiatives to give form and force to the principles of access to information, public participation, and access to courts. These different initiatives assume that these principles can and should be applied universally and that political systems need to be transparent and accountable to the public, particularly when the environment is involved. In 1999, the United Nations recognized this principle in a binding conven-

tion requiring nations to adopt a wide range of mechanisms for promoting environmental transparency and accountability.

While most people recognize a political need to exempt certain activities from transparency and accountability requirements on national security grounds, these limits should be narrowly construed. The scope of disclosures—albeit belated—regarding the impacts of Hanford and Mayak makes it harder for governments to claim the immunity of national security. Similarly, after decades of abusing its national-security exemption from state and federal environmental laws, the U.S. Department of Energy must now comply with a wide range of environmental and administrative laws, and citizens are finally empowered to enforce these laws against DOE.

The bar has been raised with respect to which activities may be exempted from transparency,

and accountability requirements. The experiences of concerned citizens in the United States and Russia regarding abuse of the national-security privilege can guide other nations in developing laws and jurisprudence on what information and processes may be exempt from the normal requirements of transparency and accountability. Other countries can learn from this lesson: secrecy in the name of national security can devastate the environment.■

Russell J. Dalton et al., *Critical Masses: Citizens, Nuclear Weapons Production, and Environmental Destruction in the United States and Russia* (Cambridge, MA; London: MIT Press, 1999); 415 pp.; cloth, \$65; paper, \$27.50.

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