Editorial & Letters

EDITORIAL

Bioethics and Biological Weapons

Biological weapons, whether wielded by the military forces of nations or by terrorists, will continue to pose a serious threat to international security for the foreseeable future. Although access to toxic material and pathogenic strains of microorganisms is restricted, covert traffic in such agents is as difficult to control as that of illegal drugs. Since international travel of microbiologists qualified to perform applied biological weapons–related research is not restricted, the international bioscientific community must do its part to prevent the proliferation of biological weaponry to nations that now do not possess them and to eliminate these weapons where they presently exist.

To prevent acquisition of weapons of mass destruction, including biological weapons, the United Nations Special Commission and the International Atomic Energy Agency must continue their activities in Iraq as called for by United Nations Security Council Resolution 697 (1991), including investigating past weapons programs, inspecting and monitoring suspect facilities, and controlling import of dual-use equipment and supplies. However, to secure peace for the long term, these activities need to be augmented by initiatives taken by nongovernmental scientific organizations. Most important, once sanctions have been lifted by the United Nations, Iraqi scientists must be brought back into the fold of the international scientific community. Communication and collaboration among scientists from all countries encourage shared values, mutual respect, and friendships. Interpersonal scientific contact with Eastern bloc scientists during the Cold War had beneficial effects and offers a model for the reintegration of scientists from countries such as Iraq.

The international bioscientific community can take immediate steps to support colleagues in every country, including Iraq and the republics that once constituted the former Soviet Union (FSU), thereby countering the international proliferation of biological weaponry. Of special concern is the risk that scientific and technical workers who once were employed in a national biological weapons program, but now are unemployed or underemployed, might be induced by proliferant countries and terrorist groups to perform illicit biological weapons–related research and development. The best way to prevent this from happening is to provide those scientists with challenging and adequately remunerated work in their home nations. Recognizing this fact, the European Union, Japan, the United States, and other nations have established international programs designed to help weapons laboratories convert to peaceful uses. These programs, including the International Science and Technology Center, the Initiatives for Proliferation Prevention, the International Association for the Promotion of Cooperation with Scientists from the New Independent States of the FSU, and the Civilian R&D Foundation for the Independent States of the FSU, should be supported and promoted by bioscientists worldwide.

Scientists of countries alleged to be sponsoring or supporting biological weapons programs should be encouraged to participate in international scientific meetings, and electronic communication links should be established. In particular, the International Council of Scientific Unions (ICSU) and professional societies should help provide the equipment and funding necessary to set up electronic mail and Internet access for scientists from developing countries. Under Article X of the Biological and Toxins Weapons Convention (BWC), which enjoins member countries to cooperate in applied microbiology, BWC members could encourage reciprocal visits between scientists and fund joint research projects involving laboratories of all countries. Through these approaches, scientists of every country would become full partners in international collaborations.

In addition, science students from nations suspected of pursuing the acquisition of biological weapons should be invited to international forums that include discussions of ethics in science. The International Centre for Genetic Engineering and Biotechnology, headquartered in Trieste and New Delhi, might lead such an effort. Scientists imbued with a strong sense of ethics will be more inclined to slow the progress of biological weapons–related research or alert outsiders to activities that violate international law. The codes of ethics promulgated by professional societies such as ICSU and the American Society for Microbiology can provide useful guidance for action.

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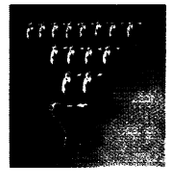
LETTERS

Counting sheep

Questions are raised about whether the cloning of the sheep Dolly, an exceptional "single observation," has been adequately confirmed. Dolly's cloners respond. The schedule for the startup of a reactor at Brookhaven National Laboratory is explained. And more discussion of how to regulate mercury in fish is offered.



Dolly Confirmation

It has now been almost a year since the cloning of the sheep Dolly from an adult ovine cell was announced (*1*). The year has brought much agonizing discussion, potential legislation, and some laurels, but no more Dollies. The principal scientist, Ian Wilmut, has announced (*2*) that he and his group have no intention of trying again (to clone using mammary DNA and a host denucleated ovine cell). Some "very soon" to be delivered (*3*) cows that were to be cloned from adult cells have yet to appear. Other rumored events seem also to have dissipated. It is a well-known tenet of science that a single observation is not to be codified until confirmed by someone in some way. The single observation gains some credence when well controlled or of a unique nature, or both. It is the lack of any confirmation that provokes our skepticism; here are some of the detailed reasons.

1) The cloning was done once out of some some 400 tries. Only one successful attempt out of some 400 is an anecdote, not a result. All kinds of imagined and unimagined experimental error can occur.

2) The characterization of the mammary gland cells used as nucleus donors was poor; it could have been one of the donor's rare stem cells that was involved, as acknowledged in the paper (*2*).

3) The reason why the donor ewe was pregnant was not explained (*1*). This is important, because the cell which led to Dolly could have been of fetal origin. Why was no analysis of the fetus and its father's genotype performed? Given these DNA fingerprints, or even the sex of the fetus, one could have excluded a fetal cell as donor.

4) The demonstration that the four