

that it has something to hide at these weapons laboratories? How can the world know without the Protocol? Is the world supposed to trust the word of the US after its long history of abuse on biowarfare research?"

Dr. Boyle's particular concern is the Bush administration's May, 2001, announcement to sidestep the testing protocols developed to adequately implement the Biological Weapons Convention cosigned by the U.S. a quarter of a century ago.

The suicide attacks of September 11th appear to have moved the administration away from what had been an increasingly isolationist posture in the world community regarding international agreements. That may be a fortunate effect arising from a calamitous cause. The post-attack atmosphere regarding terroristic use of biological weapons is, however, approaching hysteria. That is unfortunate, Colin King, of Nuclear Watch of New Mexico, says,

"Los Alamos National Labs has a history of taking short cuts and compromising safety. We're concerned that the renewed climate of fear will create a lot of new funding for these biological weapons programs and increase the haste and carelessness with which they are carried out."

Whether or not the U.S. is involved in developing an offensive biological weapons capacity, the bellicose nature of the Bush administration, along with the reckless nature of weapons research and development programs, requires an informed and alert citizenry. ■

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Embryo Stem Cells and Biobusiness at 20

BY STUART A. NEWMAN

President Bush's decision to permit Federal funding for research on existing human embryo-derived stem cells (ESC) should make it possible for scientists to explore the potential of these cells to correct a wide variety of inherited conditions and traumatic injuries. Some advocates of the research have expressed frustration that the new policy does not go far enough in making it possible to realize this technology's "enormous" promise. Others assert that pursuing the work for the time being with existing cell lines represents a way of assessing this promise without precipitously stepping over an ethical line regarding uses to which hu-

man embryos may be put. Hovering in the background of this debate is the question of whether the technology is really as promising as has been claimed, or whether its possibilities have been inflated because of patents and other commercial interests extraneous to science or medicine.

Recent news reports about disputes over embryo stem cell patent rights

have offered the first glimpse many have had into the strange new world of biobusiness. This conflict threatens to narrow access to the 30-60 (the exact number is in dispute) cell colonies or "lines" that the President's advisors have told him are potentially available worldwide to perform these experiments. The University of

Wisconsin's research foundation (WARF) owns the rights to the cell lines and to the methods for producing them reported by its faculty member Dr. James Thomson in 1998. WARF also contends that its permission will be required before many of the cell lines referred to by President Bush can be used for research that might lead to commercial prod-

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ucts. It also claims eventual royalty payments for any applications. The Geron Corporation of Menlo Park, California, which provided funds for Dr. Thomson's research, also claims a financial interest in some of the products arising from this work and has been trying to limit WARF's ability to transfer the technology to other re-

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searchers. WARF has now filed a lawsuit to prevent Geron from tying its hands.

ESCs derived from animals have been studied for 20 years and during most of that period they have been considered a research tool rather than a therapeutic hope. The first paper reporting the existence of these cells, a mouse study published in 1981 by Dr. Gail Martin of the University of California, San Francisco, seems almost quaint now in its pure science orientation, exemplified in the last line of its summary paragraph: "The availability of such cell lines should make possible new approaches to the study of early mammalian development." This may be contrasted with the corresponding sentence in the first report of human ESCs by Dr. Thomson and his colleagues 17 years later: "These cell lines should be useful in human developmental biology, drug discovery, and transplantation medicine."

Beyond the hopefulness associated with the extension of this area of research into our own species, the sanguine prediction of applications in transplantation medicine might be imagined to have flowed from scientific progress in the intervening two decades. But while there are many mouse "models" for human diseases targeted for embryo stem cell therapies—mice with diabetes, Parkinson's-like disease, muscular dystrophy, spinal cord injury—there have been no scientific papers published during the past 20 years reporting cures, and fewer than a half dozen indicating amelioration, of any of these conditions in mice using mouse ESCs. And, compared with the experimentation on people that would be required to

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develop ESCs therapies, this kind of research on mice has had few impediments.

Until news about human embryo stem cells hit the popular press three years ago, there was no significant discussion in the scientific literature of potential uses of ESCs cells as therapeutic agents, though scientists would be expected to discuss such scientific issues in the technical literature before the public learns about them.

The changes during the past 20 years that transformed the obscure scientific field of embryo stem cell biology into the hope of millions of patients, the subject of innumerable magazine articles and television programs, and the context for the first difficult decision of a new President did not primarily occur in the world

of science. Rather, the two alterations in the legal system that occurred around the same time as first stem cell report in 1981 together set a process into motion that changed the way the results of biological research are presented to the public.

The 1980 Chakrabarty decision by the US Supreme Court stipulated for the first time that living organisms (including human cells), which were previously considered part of nature and therefore not inventions, could receive patent protection. The same year also saw passage by Congress of the Bayh-Dole act, which transferred ownership rights of publicly-funded research to universities and their commercial backers. The confluence of these two events spawned the biotechnology industry, academic multimillionaires, and universities fixated on the bottom line.

Embryo stem cells may eventually live up to the promises of their most ardent advocates. But the last 20 years is littered with the failed promises of other "breakthrough" technologies such as gene therapy and fetal tissue transplantation. The world of biotechnology that came into being simultaneously with the discovery of ESCs is one of marketing and stock options as much as science. It is also a world in which normal scientific controls are compromised: it's one thing for a scientist to criticize a colleague's experiment; it's quite another to criticize his business model. In this environment, the public's health would benefit from a dose of healthy skepticism along with the hyperbole. ■

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SONG FOR A ONCE AND FUTURE PLANET

BY ANNE HEUTTE

let every earth-child
see the sun on a clear day
find fresh water to drink
and fall asleep
in a sheltering place.