Editorial

Forbidden Knowledge and the Cloning of a Lamb

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The British Scientific Journal, *Nature*, February 27, 1997, published a landmark article of momentous importance, not only to science and medicine but to all of human kind.

The paper, *Viable Offspring Derived From Fetal and Adult Mammalian Cells*,¹ is from the Roslin Institute in Edinburgh. Using the DNA from an adult mammal, a sheep, Ian Wilmut, the senior author, and his colleagues succeeded for the first time in creating a lamb that is a clone of that adult. A year earlier, in that same journal, *Nature*, the Roslin group had reported the cloning of a sheep by nuclear transfer from a cultured cell line, but in that experiment embryo-derived cells were used as the nuclear donors.

In the current experiment, the genetic material came from a mammary cell of a six-year-old adult sheep. In his article Wilmut said that the fact that a lamb was derived from an adult cell confirms that differentiation of that cell did not involve the irreversible modification of genetic material required for development to term. The cells in tissue culture were manipulated so that the DNA became quiescent. The genetic material was removed from an egg cell of another ewe. This cell was in turn fused with a donor cell from the udder of an adult lamb, containing all of its DNA. The process that involved using a small electrical shock is perhaps to some reminiscent of electricity used by Dr. Frankenstein to give life to his subject in Mary Shelley's classic nineteenth century science fiction novel. The developing embryo was then installed in a surrogate mother.

Some have compared Wilmut's successful experiment to the release of nuclear energy in its potential for good and evil.

The possibilities beggar the imagination. Genetic engineering and cloning may create pharmacologic proteins, with far reaching potential for treating hitherto untreatable diseases from hemophilia to cystic fibrosis and others not yet even imagined—for example, the development of animals with organs compatible with human immune systems. And yet this research raises the specter of human cloning with ramifications until now confined to the fertile imagination of such writers as Aldous Huxley and the 1970s movies such as Woody Allen's *Sleeper* and *The Boys from Brazil*, which, respectively, sought to clone a world leader from a tissue remnant and to clone multiples of Hitler.

While ethicists and religious leaders ponder the implications of Wilmut's biological breakthrough, and President Clinton bans the use of federal money for cloning humans and related research and calls for a voluntary moratorium by those working with private funds, and predictably appoints a blue ribbon committee to report within 90 days and tell him what to do, it occurs to me that perhaps the most fundamental issue raised by Wilmut's success is whether he and his co-workers have entered that shadowy realm of forbidden knowledge.

*Forbidden Knowledge*² is the title of a 1996 book by Roger Shattuck, a former World War II bomber pilot become Professor of Modern Languages and Literature at Boston University and internationally recognized in the field of literary criticism. His volume, *Forbidden Knowledge*, may very well be one of the most extensive and searching studies of the issues and dilemmas epitomized by Wilmut's classic experiment. Had Wilmut's work been completed a year earlier it would have, without question, commanded Shattuck's attention in his book.

The first words of Shattuck's forward define the purpose of his book: "Are there things that we should not know? Can anyone or any institution in this culture of unfettered enterprise and growth seriously propose limits on knowledge? Have we lost the capacity to perceive and honor the dimensions of such questions?"

Thus, Shattuck begins his exploration of man's insatiable desire to conquer the unknown.

Darwin's 1859 *The Origin of Species* unleashed a storm of discussion and protests not unlike that which I am sure will follow Wilmut's experiment, and yet, while Darwin offered a

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hypothesis or theory, Wilmut has done something very real to which society will have to respond with more than the acceptance or rejection of a theory.

I trust that our responses to Wilmut's discovery will not mirror that of one Victorian matron, a bishop's wife, who became famous for a remark made during the controversy on evolution caused by Darwin's ideas. She said, "... descended from apes, my dear, let us hope that it is not true, but if it is, let us pray that it will not become generally known."

Shattuck traces the history of man's attempts to extend human knowledge into the forbidden or unknowable begins with the example of Prometheus, the demigod who stole fire from Zeus in order to help mankind. And he cites perhaps the most famous pursuit of forbidden knowledge which occurred in the Garden of Eden. Another example—Dante's search for knowledge that lies beyond human knowing. And Ulysses' quest as expressed by Tennyson, "... yet all experience is an arch through which gleams that untraveled world, whose margin fades forever and forever when I move." Dr. Faust and Dr. Frankenstein also sought to know and to experience the unknowable. And the gentle Dr. Jekyll became Mr. Hyde in his search for what might be called the unknowable or the forbidden. With these and many other allusions to history and literature, Shattuck defines his thesis that mankind's desire for Tennyson's "untraveled world" and for the unknown and perhaps the unknowable is inexorable and cannot be limited or restrained.

After pursuing this theme through legend and literature, Shattuck moves to contemporary scientific reality. J. Robert Oppenheimer, the theoretical physicist, and a driving force in the World War II atomic bomb project ultimately became a troubled philosopher when he contemplated the awesome consequences of his scientific success. In 1947 he said, "In some sort of crude sense the physicists have known sin." When Oppenheimer saw the mushroom cloud of the first atomic bomb exploded at Alamogordo, New Mexico, he quoted from the Bhagavad-gita, "Now I'm become death, the destroyer of worlds." But in 1994, Edward Teller, another gifted nuclear scientist who also made monumental contributions said, "There is no case where ignorance should be preferred to knowledge—especially if the knowledge is terrible."

Shattuck contrasts pure with applied science and reminds us that the disinterested pursuit of science and truth is an activity which will have profound and unpredictable effects when that knowledge is applied.

Shattuck goes on to tell us how Galileo, Bacon, and Copernicus pushed the limits of inquiry and set science on the path of independence from religious restraint.

Nicholas Rescher in a 1984 book titled *The Limits of Science*,³ said, "... there seems to be no knowledge whose possession is morally inappropriate per se, here inappropri-

ateness lies only in the mode of acquisition or in the prospect of misuse."

But in spite of all his erudition and searching analysis of mankind's curiosity and thirst for what is not known, Shattuck offers no simple solution and he has his doubts. Toward the end of the book he says, "... science and art have enlarged our way of life, but in extreme cases may now endanger it." History leads us back to the question, are there things we should not know? Shattuck suggests that religion generally says yes, and philosophy generally says no.

Although Shattuck returns to this question several times, he never fully answers it, and at the last leaves us with a somewhat mixed message on the question of forbidden knowledge. While recognizing a lingering conflict between religion on the one hand and science and art on the other, Shattuck believes that history counsels that science and art should be maintained under what he calls civilian control, warning that Dr. Faust too easily may become Dr. Frankenstein.

Even though Shattuck may be correct that history offers a cautionary view of limitless expansion of scientific knowledge, and while ethicists and philosophers may ponder these issues and Presidential commissions may render judgments, a more realistic view of history tells us that knowledge and scientific progress will not be restrained, and what can be known will be known, and what can be done will be done. For this reason, it is the proper application of knowledge and science for which society must strive because human curiosity and ingenuity will not be restrained.

The concept of forbidden knowledge has mundane implications even for today's medicine. Some, for example, would deny or limit diagnostic procedures because they may lead to what might become inappropriate interventions. But the fact that knowledge, in the instance of a patient, may be misused is not a reason not to acquire the knowledge.

Wilmut's work in Edinburgh can lead to endless benefits—the control of disease, transplantation of organs,—and yet that same knowledge and technology can be perverted. An enlightened society is not one that suppresses knowledge, but one that learns how to use it appropriately. But this, too, is patently simplistic because in all facets of human activity as in medicine, what is appropriate to some is an anathema to others. And so it will be with the cloning of the lamb.

References

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