

**DR. FRANKENSTEIN, I PRESUME?**

**The scientist who cloned the first adult  
mammal is worried: that his research might be  
misused -- or that it might not be used at all.**

[BY ANDREW ROSS](http://www.salonmagazine.com/archives/welcome/biography.html#ross)

**“R**esearchers Astounded ... Fiction Becomes True and Dreaded Possibilities Are Raised." So went the headlines in Sunday's New York Times about Dr. Ian Wilmut, the embryologist in Edinburgh who has made history by creating a lamb from the DNA of an adult sheep. The research, performed at the Roslin Institute in Edinburgh, was sponsored by a drug company, PPL Therapeutics.

Dr. Wilmut says the primary purpose of the cloning is to advance the development of drug therapies to combat certain life-threatening human diseases. Other scientists, especially in the United States, appear to have adopted a more apocalyptic view of the news. "It basically means there are no limits," Dr. Lee Silver, a biologist at Princeton University, told the New York Times. "It means all of science fiction is true." Dr. Ronald Munson, a medical ethicist at the University of Missouri, said, "This technology is not, in principle, policeable." Munson even speculated about the possibility of cloning the dead.

Are such scenarios remotely possible? And if drug treatment is the main priority, how soon will we see animal clone-based drugs on the market? Salon spoke with Wilmut by telephone from his home in Edinburgh.

**Science fiction. Cloning the dead. A technology out of control. What do you make of such reactions to your work?**

I think they're over the top. The point is that what we thought happens in all life is that you have a single fertilized egg and as it divides, it progressively differentiates and you get brain and muscle and all of the different kinds of cells that we have, People assumed until now that this was an irreversible process. And what we have shown is that it's not. Now people will have to think in slightly different ways about the mechanisms that control these changes -- for example, about what happens when things go wrong and you get a cancer instead of a normal development. So it is going to open people's eyes a lot in terms of biology.

**And does it mean that cloning humans is possible?**

We don't know. It is quite likely that it is possible, yes. But what we've said all along -- speaking for both the (Roslin) Institute and the PPL staff -- is that we would find it ethically unacceptable to think of doing that. We can't think of a reason to do it. If there was a reason to copy a human being, we would do it, but there isn't.

**Is the idea of cloning the dead totally fanciful?**

Yep.

**Still, even if you can't clone the dead and you see no reason to clone the living, the genie is out of the bottle, so to speak. Others might find reasons for human cloning, and they may not have the same standard of ethics as you.**

That does worry me, both in principle and in detail. It worries me in detail because the successes we have at present are of such low efficiency that it would really be quite appalling to think of doing that with people. I would feel desperately sorry for the women and the children that were involved.

**Why? Because the clone could turn out to be some kind of monster?**

It's possible. Perhaps you don't know that in the first experiment that we reported, five lambs were born alive and three of them died quickly. There was nothing monstrous, they just simply died. That in itself is very distressing if you think of a mother who carries a child and it dies within a few days of birth.

**Your main goal, you have said, is to develop health-related products from animal clones. In what areas, specifically?**

Haemophilia. With animals, you could make the clotting factors which are missing. It could also be beneficial for cystic fibrosis.

**What's the difference between using animal clones and other kinds of biotechnology techniques?**

Speed and efficiency. You could take cells from an animal, grow them in the laboratory and make very precise genetic changes -- it's called gene targeting -- which you insert in the cloned offspring. So, for example, you put into the cells of the offspring DNA sequences which would say, "Don't make this particular milk protein, but instead make clotting factor 8," which is needed for haemophilia. You can do that now, but by using a much more primitive technique. Cloning and gene targeting requires fewer animals. It will be quicker, which means new health products will come on line more quickly.

There's another major advantage. Presuming this technique with sheep will successfully extend to cattle and then to pigs, it will speed xeno-transplantation -- using organs from pigs to treat human patients. That can be done now, but what happens now is that you put a human protein into the pig organ which kind of damps down the immune response in the transplant patient. Now with gene targeting, we can do that, but we can also change the *surface* of the cells, so that they would be less antigenic when the pig organ is put into a human patient -- which makes it more likely that organ transplantation will work.

**So, instead of waiting for a human donor, we'll be seeing many more animal organ-to-human transplants.**

Yes, with pig organs in particular.

**And who would be helped the most?**

Well, there is a need for more hearts and more kidneys. At present people die before human hearts can be made available to them.

**There have been attempts to use baboon transplants in AIDS patients.**

Yes, but people feel it's more acceptable to think of using pigs because baboons seem so much more --

**-- human?**

That's right. Aware of their environment.

**With animal cloning research, will it be possible to go in and fix genetic defects in humans? For example, there are already tests for a predisposition to breast cancer.**

I think that is so far away that it's not really credible. I mean you're quite right theoretically. But the efficiencies we have at the present time and our understanding are so naive and primitive that you wouldn't contemplate doing it. I think we could contribute in a smaller way to certain genetic diseases -- breast cancer is not one that I've thought of -- but, for example, with cystic fibrosis. It has been suggested that we study the role of the gene which is defective in people who suffer from cystic fibrosis with the hope that better therapies can be developed. We could also provide model test animals in which methods of gene therapy can be developed.

**Which is being done with mice.**

Yes, but mice are so different and so small that experimentation is very difficult. Sheep would be much more appropriate.

**Do you see a therapy for cystic fibrosis based on animal clones in your lifetime?**

Yes. I'm 52, I reckon I've got 20 years. I'm fairly comfortable predicting we'll see something in that time period.

**In addition to drug therapy for humans, your research has major implications for animals.**

Yes, it may open a whole range of things we can't imagine at the present time. Remember, we only know about what, 5 or 10 percent of the animal genes? But there is a particular project which is of immediate relevance in Britain concerning the disease scrapie.

**Mad Cow Disease?**

That's right. What people believe is that the agent which causes scrapie in sheep causes BSE (Bovine Spongiform Encephalitis) in cows and some of the CJD (Creuzfeld-Jacob Disease) in humans. It is believed to start with a particular gene in sheep. Now what if we could modify that gene; could we make sheep that are resistant to scrapie? That's very important for sheep, but also for BSE and CJD in humans.

**When?**

Twenty years or so.

**There is also talk of "supercows" producing enormous quantities of milk. Could it be made cholesterol-free, by the way?**

There are all sorts of questions like that. The answer to them is, we don't know. One thing I would say is that history shows that people are very bad at predicting the way that technology will be used.

**Any implications for world hunger?**

Not immediately. But if we can maybe make animals resistant to some diseases -- to the tsetse fly, for example -- it is quite possible that we can contribute to a whole range of things.

**You've been working on this project for 10 years. Did you ever ask yourself, "Am I Dr. Frankenstein here? I know what I want to achieve but am I contributing to something I don't want to see happen?"**

Of course. And we've tried to have this information released responsibly to journalists like yourself, to ethicists, to people concerned with legislation, because what we want is to stimulate an informed public discussion of the way in which the techniques might be misused as well as used and to ensure legislation was put in place to prevent misuse. But what we're also concerned with as well is that we don't throw the baby out with the bathwater. There are real potential benefits, and it's important that the concern to prevent misuse doesn't also prevent the really useful benefits that can be gained from this research.

**What misuse are you most concerned with?**

Any kind of manipulation with human embryos should be prohibited.

**Are you concerned that your work will be stopped?**

I have some concerns about it. I totally understand that people find this sort of research offensive, and I respect their views. It's also possible for a minority to have very large influence. Now, if society says it doesn't want us to do this kind of research, well, that's fine. But I think it has to be an overall view made by an informed population.

**Assuming it goes forward, when will we see the first concrete applications?**

I think there will be animals on the ground with interesting new products in three years. I think we'll come up with clotting factors, possibly in cattle as well as in sheep. Of course there will be a long time for testing the products before they go into commercial use. But there will be animals that are able to secrete new proteins, different proteins, in three years.   
**Feb 24, 1997**

In pairs, complete the following activity.

* Use the interview to identify three hopes and three fears about human cloning.
* Craft three additional questions that your group would ask Dr. Wilmut.