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The meaning of life

'Pro-life' groups define the beginning of human life as the union of sperm and egg, and equate the harvesting of human embryonic stem cells to homicide. But our biological understanding lends little support to these views.

Last week, a private clinic in Virginia further inflamed the debate over embryonic stem (ES) cell research. Researchers at the Jones Institute for Reproductive Medicine in Norfolk announced that they had created human embryos by *in vitro* fertilization for the sole purpose of harvesting ES cells. 'Pro-life' groups denounced the clinic. "It's still killing a human being," a representative of the Virginia Society for Human Life told *The Virginian-Pilot* newspaper.

Central to this argument is the view that human life begins at fertilization. ES cells show promise in the field of regenerative medicine, which seeks to grow tissues to replace those lost to disease or injury. But they are harvested by destroying an embryo comprising a hollow ball of cells called a blastocyst. The idea that this represents the destruction of a human life has an appealing moral simplicity.

Biology, however, is not that simple. Recent advances in reproductive medicine have emphasized that mammalian life need not start with the union of sperm and egg. Fertilization is not required to create embryos by nuclear-transfer cloning, the technique used to produce Dolly the sheep.

And earlier this month at a meeting in Lausanne, Switzerland, an Australian team described experiments in which mouse eggs were 'fertilized' with cells taken from adult mice. The resulting embryos contained an extra set of chromosomes, but could be induced to expel them and begin to develop as normal.

Those who oppose the extraction of ES cells from human blastocysts also tend to oppose such experimental manipulations of reproductive biology. But the natural phenomenon of identical twins similarly creates problems for the simple view that human life starts at fertilization. An embryo can split to form two or more viable embryos at any stage up to 'gastrulation', when its cells begin to migrate into distinct layers that form the basis of the adult body plan.

Because of twinning, many bioethicists take the view that it is only after gastrulation that an embryo can begin to be considered as an individual human being. This definition can be applied whether an embryo is created by conventional fertilization or by any other procedure. It does not deny that pre-gastrulation embryos are alive — but then so too, in some senses, are sperm and egg cells.

Framing the discussion over ES-cell research in the context of when biological individuality arises, rather than when life begins, could lead to a more meaningful debate. That is why it is disappointing to see one of the companies working on ES cells apparently buying into the 'life begins at fertilization' argument.

Advanced Cell Technology (ACT) of Worcester, Massachusetts, says it is trying to generate human embryos by cloning, and then harvest ES cells from them. The company hopes to sidestep moral objections, as fertilization is not involved. Indeed, the chair of ACT's ethical advisory board argues that an embryo created in this way is not a bona fide embryo, and suggests the term 'ovumsum'.

The procedure that ACT is experimenting with, known as therapeutic cloning, might one day prove useful in generating ES cells that are genetically matched to patients requiring tissue grafts. But to suggest that it does not involve the creation of embryos is misleading.

In 1990, the British parliament was persuaded in favour of allowing a limited range of research projects on pre-gastrulation embryos by arguments that such embryos have not progressed to the point that they can be considered as individuals. Exactly the same logic can be applied to the current ES-cell debate. ■

Can the leopard change its spots?

With less politics and more money, Italy's scientific community could take its rightful place among the world's élite.

Italy's research organizations are midway through a major process of reform, designed to sweep away the bureaucracy and deal-making that have beset them for decades (see page 264). But Italian scientists retain a degree of scepticism. They like to quote from *The Leopard*, Giuseppe Tomasi di Lampedusa's classic tale of late-nineteenth-century Sicilian politics: "Change everything so that everything remains unchanged."

If Italy's overpoliticized and underfinanced science base really is to change, two obvious things are needed: less politics and more money. In this context, 'politics' means the academic wheeling and dealing that in Italy is institutionalized by an overdose of democracy. Important decisions in Italian academia, including the distribution of research funds and senior appointments, are in the hands of committees directly elected by the academic communities they represent. The result, unfortunately, has been a system in which votes are frequently traded for favours, and which fails to reward excellence.

The reforms have successfully de-democratized a few key academic committees. For example, a new committee that distributes small grants to individual university researchers is now composed of a handful of top academics appointed by the research ministry. It works well, concentrating funding in the best labs.

But this is still not the case for most other committees. That is why the whiff of the leopard still lingers over Italy's system of academic promotion, where most members of the new-styled selection committees are still elected, and around the corridors of the CNR, the national research council.

Italian science has an important contribution to make. Statistics published last month by the European Commission show that, although the number of scientific publications out of Italy is well below the European average when computed per million population, the number of highly cited papers exceeds the European average when expenditure is factored in.

The commitment of Italy's new centre-right government to the scientific reforms instituted by its predecessor is unclear. But if education and research minister Letizia Moratti can wean the scientific community away from inappropriate elections, and back successful reform with investment compatible with Italy's status as a G8 economic power, the rewards could be great. ■

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