

Identity and Difference in the Global Era

Coordinated by
Candido Mendes

Edited by
Enrique Rodriguez Larreta

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Dolly the World-Famous Sheep

Sarah Franklin

The cloning of Dolly the sheep has widely been described as one of the most important scientific events of the last century, comparable to the splitting of the atom, the discovery of DNA, and the elimination of smallpox. Ian Wilmut, the scientist whose team succeeded in cloning Dolly at the Roslin Institute in Scotland, describes her as “the most extraordinary creature ever born”. With the birth of Dolly, Wilmut claims, we entered a new age of biological control. Wilmut predicts that:

As decades and centuries pass, the science of cloning and the technologies that flow from it will affect all aspects of human life—the things that people can do, the way we live, and even, if we choose, the kinds of people we are. Those future technologies will offer our successors a degree of control over life’s processes that will come effectively to seem absolute. Until the birth of Dolly scientists were apt to declare that this or that procedure would be “biologically impossible”—but now that expression seems to have lost all meaning. In the 21st century and beyond, human ambition will be bound only by the laws of physics, the rules of logic, and our descendants’ own sense of right and wrong. Truly, Dolly has taken us into the age of biological control.¹

In her viability, in her very modest existence as a seemingly ordinary sheep, Dolly symbolises human transcendence over

nature—her birth was brought into being the age of biological control, of absolute control, in which biology has come to be seen not as a limit, but as an unlimited capacity. Dolly was an experiment before she became the founder animal of a whole new lineage of reproductive possibility, before she became a totemic animal for all of our biotechnologically-assisted futures. Paradoxically, it is her very ordinariness that is seen to be almost a miracle. Paradoxically too, Dolly is a singleton—there could have been several Dollys, but there is only one. Although she is a clone, she is also an individual, and even Ian Wilmut himself admits there could never be another Dolly. Oddly, then, she is one of a kind, much as her existence symbolises the very opposite, the spectre of the loss of individuality or distinctiveness.

Dolly is a mixture that refigures familiar categories, and her very existence poses many questions about the so-called biological facts of sexual reproduction upon which so many of our understandings of identity and difference, or of nature and culture, are based. Dolly is both born and made, bred and manufactured. She is a product of technological innovation, as well as corporate investment, and scientific accomplishment. Her birth is the manifestation of many forms of desire—in particular, the desire to transcend the biological limits formerly assumed to make the cloning of a higher mammal from an adult cell an impossibility. But these desires have been met with mixed emotions: many see Dolly as an expression of an unnatural wish.

Dolly is also a new kind of domesticated animal—indeed it could be said her making extends what domestication means to a whole new level, in that the entire history of animal breeding, or husbandry, is redefined by her existence. The moulding of animal flesh to meet the demands of human economy and society is as

old as history itself. Even in the Bible, sheep are the first animals to be tended, and it could even be claimed that it is sheep, not dogs, who are “man’s best friend”. Sheep symbolise animal domestication in many respects, towards which humans feel both an appreciation and a kind of discomfort. Dolly would be a much more threatening figure if she were not a sheep, who are both figures of fun and symbols of a kind of abject subordination. The very qualities that make them so human friendly—their herd instincts and susceptibility to being led make them often objects of amusement. Yet sheep have an inestimable importance to human history and in particular to human economic growth. The viability and plasticity of British sheep has long been a source of their inestimable value to the British people in the modern era. Sheep first came to Europe from Asia over 5,000 years ago, and in Britain, as in many other parts of Europe, their unique ability to survive under the most inhospitable conditions, in some of the most exposed and remote parts of the country, and with very little assistance from their keepers, has made of them a highly prized source of wealth, as well as a definitive feature of the landscape.

As the recent foot-and-mouth crisis in Britain has revealed, sheep continue to be a vital component of the nation’s economy, existing practically everywhere across the country, from the Scottish Highlands to the lowland English moors of Devon and the West Country. Many breeds of sheep remain distinct in Britain. The diversity of British sheep corresponds to the wide range of environments they inhabit and the many uses to which they are put, for wool, for meat, for milk, for breeding purposes, and to improve the land. Indeed it is almost impossible to imagine the contemporary British countryside, its deforested green hills and dales, without imagining those hillsides covered with sheep.

Sheep epitomise the countryside which belongs to the industrial heritage which gave the British landscape its contemporary form. The social historian Fernand Braudel claims the industrial revolution arose in the North of Britain in no small part because of the extent to which sheep had transformed non-arable land into soil fit for agriculture.

The unique importance of sheep to ideas of Britishness, of British industrial heritage, and British countryside was recently made explicit as part of a campaign to “rebrand” Britain, for which John Williamson, a design consultant from the firm Wolff Olins, proposed “three sheep representing complementary images of Britain—natural heritage and tradition; radical eccentric British culture and creativity; and [British] leadership in innovation, science and technology”. In this proposed rebranding strategy, ideas of nature, culture and industry are woven together in sheep’s wool, to suggest the fabric of a nation. In these symbolic images of sheep, innovation and tradition are united into a picture of British industry, iconoclasm, and individual creativity. The figure of the sheep, so central to the Christian tradition as well as a kind of native English pastoralism, represents both the husbandry of human over animal, and the watchfulness of the Divine Shepherd over his flock.

She may be a sheep, but Dolly is a national monument and a global celebrity, her image so frequently reproduced it is rumoured to be the subject of a patent application, similar to those protecting the images of Elvis Presley, Marilyn Monroe, Princess Diana, or the Empire State Building. She is already destined for a display case in the Royal Museum of Scotland, and it was seriously debated on Radio Four that a sculpture of Dolly caps the empty third column in Trafalgar Square.

Sheep are thus important culturally, as icons and even as a definitive signifier of what is specifically British. But this symbolism is rooted very deeply in their economic value. The importance of sheep to Britain’s industrial heritage has always relied on the viability of sheep as forms of capital—as breedwealth, or live stock. It turns out sheep have a very privileged place in the strategies of capital accumulation which made of Britain not only a leading industrial nation, but an empire. British sheep breeds were exported all over the world, and nearly all of the leading commercial sheep breeds in existence today arose in Britain, which is still considered the hub of the world system of sheep breeding.

The Roslin Institute, where Dolly was both born and made, is a direct descendant of the Imperial Bureau of Animal Breeding, based in London. And the viability of sheep is as important to the British biotechnology industry today as it has been to Britain’s industrial successes in the past. As sheep were instrumental to the emergence of the industrial revolution in Lancashire two centuries ago, so are they of equal importance to the industrialisation of life today. Indeed, although Dolly is a global animal in important ways that are unprecedented, it is worth remembering the extent to which sheep breeding was already a global industry even in the eighteenth century—as Karl Marx, among others, clearly recognised.

However, while it is not, therefore, “new” to speak of animal bloodlines and animal genealogies as conduits for capital, or wealth accumulation, or even national identity, these have today taken a new form. While it is not unprecedented to observe the ways in which national economies are in part conducted through animal breeding, there is a new significance to the kind of repro-

duction Dolly guarantees as viable. In the same way sheep have been important to definitions of wealth, nation, heritage, and empire—*so today they are beginning to redefine what it is to be human as well.*

Dolly is not only viable as an offspring, but as a scientific accomplishment. Her viability guarantees the success of a particular technique of reproductive biology, and her reproductive success is part of a larger corporate strategy. Dolly embodies a valuable form of intellectual property: she is the animal model for a patent which was relicensed to the American corporation, Geron in 1999, for twenty-six million dollars. Dolly's net worth is now part of a publicly-traded NASDAQ company, in which her value is both as a kind of celebrity animal and as a kind of animal futures market. Dolly is, in sum, a unique form of genetic capital.

One way to examine the importance of Dolly in the global economy, then, is to consider the way in which her reproductive powers have been commoditised, traded, sold, and owned as forms of private property. Dolly is not only an animal who inaugurates new forms of biological control, she also embodies what I call a new form of global biology. Economically, Dolly has a complex genealogy. Some of the cells used to make her were owned by PPL Therapeutics, a private Scottish biotechnology housed on the same premises as the Roslin Institute outside Edinburgh. Other of Dolly's parent cells, if that is what to call them, came from sheep purchased in sheep markets by the Roslin Institute itself, which is a publically-funded agricultural research facility and a research division of Edinburgh University. Dolly's body is thus itself literally a fusion created out of a public-private research partnership, which is yet another mixture she makes viable.

The commercialisation of the germplasm that is made more profitable and is extended through Dolly's complex pedigree comprises the uncomfortable end of our newfound proximity to sheep. It would be one thing if we could as easily imagine our separateness from sheep as we might like to: for they are, after all, farm animals. The global biological is not just about the extent to which a single animal can embody complex world economies in her genome. It is also about the extent to which we increasingly recognise our own biologies in this mix, often in somewhat uncomfortable ways. It is a legacy of the birth of modern biology, through the work of Darwin, who unified all of life into a single system of shared descent, that human reproduction is not very different from that of sheep. It is easily forgotten that Darwin relied largely on studies of domestic animals, not wild species, to develop his model of evolution through selective adaptation. Unlike many of the societies studied by anthropologists, in which human reproduction is seen to be *distinct from that of animals*, the Darwinian legacy of the industrial era tells us that not only that *people reproduce more or less in the same way animals do*, but that we are in fact *descended from animals ourselves.*

This simple observation explains quite readily why there was such worldwide curiosity and disturbance surrounding the cloning of a *sheep*: because what can be done to sheep can, by implication, also be done to humans. This too is why the transformation of Dolly's genealogy into a form of "live stock" or breedwealth bears heavily upon the public consciousness. *The proximity of genealogy to capital is made that much more explicit.* The dangers of this proximity have become more unsettling. The cross-breeding of human genes into sheep such as Polly, the first transgenic ewe, make us worry about the road

ahead, whether there is going to be a ewe turn, and whether counting sheep may turn out to keep us awake at night instead.

Perhaps in the same way we first became intimate with sheep by eating them, we now share another complicated vector of attachment in the discovery of how closely our own reproductive futures are intertwined with these woolly doppelgangers. After all, human DNA is already coiled up in the genomes of transgenic sheep like Polly, and it is in part this dilemma which leads us to so much joking and humour about the cloning of sheep. Sheep are in the popular imagination as human substitutes: and it is in this mirror that we see our own futures uncomfortably reflected back to us. Against the backdrop of crisis such as the epidemics of BSE and foot and mouth in Britain, and in the context of ongoing debate about the genetic modification of plants, animals and micro-organisms, Dolly the cloned sheep acquires a somewhat more threatening profile.

This fact has become even more vivid as new uses of cloning are proposed as a means of providing replacement human tissue in order to treat diseases such as liver failure, cancer, and macular degeneration. As a wide range of new stem cell technologies fuel the emerging science of tissue engineering, enabling the molecular rebuilding and reprogramming of body parts, ours and Dolly's bodies become even more densely intertwined. It turns out we are all Dolly mixtures.

To make Dolly, Wilmut and his team isolated a mammary cell—a somatic, or body cell, which had already differentiated into the one-way specialisation that makes eye cells eye cells, and liver cells liver cells, and mammary cells mammary cells. Wilmut's team then took an ovum, or egg cell, from another sheep and removed its nucleus, its tiny sac of DNA, leaving the

rest of its contents intact. Ovum cells are much larger than somatic, or body cells. The ovum is a germ cell, a reproductive cell, a cell which has the capacity to become an embryo, and thus any part of the body—indeed all its parts. By fusing the enucleated ovum with the much smaller mammary cell, the Roslin team created a reconstructed cell out of one animal's nucleus, and another animal's enucleated ovum.

If we read this narrative from an Aristotelian, or patriarchal, point of view, it might seem as though the donor egg cell was in a sense seeded, or fertilised, by the nucleus of the mammary cell with which it was merged. In many popular representations of Dolly's conception this is exactly the impression given. For example it is often, wrongly, stated that the Roslin team only introduced the nucleus of the mammary cell into the enucleated donor ovum—as if the technique were a matter of nuclear replacement. In this version, the new nucleus provides the mastercode which determines subsequent development. An increasingly familiar form of genetic determinism is also reflected in this description—as if the only “real” contents of a cell were its genes.

Of course, cells contain much more than DNA, and in addition to organelles such as mitochondria or ribosomes their main ingredient by far is the cytoplasm. Often described as the “soup” in which all of the cell's contents are floating, the cytoplasm itself has a role that was of great interest to the Roslin team. As Ian Wilmut explains,

nuclear DNA does not operate in isolation. It is in constant dialogue with its cytoplasmic environment; the cytoplasm makes a difference. (p. 74).

It was, in fact, this difference which enabled Wilmut and his team to succeed in producing Dolly. For at the heart of their ex-

periment was the attempt to make an adult differentiated cell behave like a germ cell—a cell with unlimited potential. To do this, the Roslin team essentially harnessed the vast power of the egg cytoplasm to re-instruct the nucleus of the mammary cell to recommence its own development—that is, to go back in time. As Wilmut notes,

all of the instructions which direct the whole process of cell division are provided by the cytoplasm. (...) In short, the DNA in the early embryo effectively does what it is told. (p. 142-3.)

Thus, by using the donor egg cytoplasm to reprogram, or re-instruct the nucleus of the mammary cell—to make it go back in time, de-differentiate, de-specialise, and become newly primordial—Wilmut was able to clone Dolly.

It turns out the egg, with its 100 times greater volume of cytoplasm than any mammalian body cell, can be used as a reprogrammer. And it is this ability to reprogram cellular instructions which enables new kinds of cells to become embryos, and in turn animals such as Dolly.

Dolly is as a consequence a kind of “smart sheep”, in the way houses can now be made “intelligent” by having various programmable parts—ovens you can activate with a mobile phone, rooms that know when you walk into them and televisions that can suggest, via the internet, what you might want to buy this week from Sainsbury’s. Dolly has a virtual interior—a genealogy that is itself a kind of reprogrammed supercomputer. Dolly epitomises a collapse between the virtual, or informatic mode, and the biological. She stands at the intersection where life’s machinery, which was famously refigured as machine-like in the Enlightenment period, when the heart became a pump under Harvey, and the anatomist

became a kind of reverse engineer, has now become a virtual environment, and the biologist, a systems theory manager, redesigning the basic cellular mechanisms to recapitulate what was formerly presumed to be hardwired by nature. This is how Dolly extends the idea of domestication to intersect with what looks more like tissue engineering, which is, in fact, what cloning by nuclear transfer has inaugurated as a science.

Dolly is consequently not only a global celebrity, but an embodiment of a new global biological which changes the very meaning of life itself. The capacity to rewrite genealogy alters the relational grid described by Darwin as descent through modification from a common ancestor. The new modifications enable entire new kinds of animals to be produced, which criss-cross the genetic material of animals, plants and microorganisms into new kinds of kinds. Neither breeds nor species, the new varieties of transgenic life do not conform to a Darwinian grammar of existence. Their coming into being signals the prolific viability of the biotechnological, congealing powerful scientific, commercial and national interests into patented cell lines, cloned embryos, and transgenic fish.

What is notable about the global biological is not only its worldwide economic significance in the production of new industries and markets for biocommodities. It is also the site of the production of new forms of biorisk which pose very volatile questions about the futures of human health, human subsistence, and human reproduction. The attempt more fully to domesticate the biology of animals such as sheep also poses the question of a loss of biological control, in the form of environmental destabilisation, new forms of disease, and other avenues of unpredictable contagion.

It is fitting a sheep should pose such questions to us, as these animals have for so much of recorded human history formed a pivotal connection between agriculture and the economy. The complicated ways sheep have been folded in to human societies is epitomised by the global celebrity of Dolly, the world's most famous sheep. Truly a totem of our time, Dolly symbolises a future we all will share, in which biology is less about what we are than what we can be recreated to become. As our genealogy is transformed from an unalterable condition of existence into a template for genetic modification, our sense of ourselves as human is also transfigured. This is truly where the significance of cloning lies—at the heart of the identities and differences through which we understand and imagine ourselves and our futures.

Note

1. See Ian Wilmut, Keith Campbell, Colin Tudge, *The Second Creation: Dolly and the Age of Biological Control*, New York, Farrar, Straus and Giroux, p. 17.