

DOLLY'S BODY: GENDER, GENETICS AND THE NEW GENETIC CAPITAL

SARAH FRANKLIN

The birth of Dolly, the now-famous cloned Scottish sheep, was first reported on February 23rd, 1997 in the British Sunday paper *The Observer* by its science editor, Robin McKie. Later that week the means of her creation were officially documented in the British science journal *Nature*, in an article by Ian Wilmut and his colleagues entitled "Viable offspring derived from fetal and adult mammalian cells."¹ Like that other famous British birth, of the world's first test-tube baby, Louise Brown, in June of 1978, Dolly's viability instantly became the subject of world-wide media attention and public debate. Her birth was seen to alter the landscape of future reproductive possibility, and once again to raise questions about the ethics of man-made life.

In the first full-length account of the making of Dolly the sheep, *Clone: the road to Dolly and the path ahead*, *New York Times* science journalist, Gina Kolata describes the cloning of Dolly from an adult cell as one of the most important scientific accomplishments for which the previous century will come to be known, comparable to the splitting of the atom, the discovery of the double-helix, and the elimination of smallpox (Kolata, 1997). According to the most comprehensive account of Dolly's birth, written by the Roslin scientists who created her, Dolly inaugurates a new era, "the age of biological control" (Campbell, Wilmut and Tudge, 2001). Prominent ethicists, philosophers, and scientists have spoken out about cloning, testified before Congress, and published their views in editorials and anthologies. Numerous advisory and legislative bodies world-wide have provided reports and recommendations.² Controversy continues to surround the question of whether or not humans should

¹ In fact, Dolly was already more than six months old at the time of her birth announcement: she had come into the world in a shed in a small Scottish village on the fifth of June 1996.

² A list of several of these reports and anthologies about cloning is provided in the references to this paper, which is part of a larger project on kinship and cloning supported by a fellowship from the Leverhulme Foundation.

be cloned, and has now been extended to include wide-ranging debates about cloning human tissue via stem cells and the emergent science of what has become known as tissue engineering. A different set of questions about the cloning of Dolly arises from the perspective of anthropology and feminist theory in relation to kinship, gender and biology. In this article I explore the notion of “viable offspring” from the perspective of the relationships between kinship, genealogy, and property which shape ours and Dolly’s futures in the “Age of Biological Control.” Using Dolly as a kind of shepherd, I want to follow the implications of her creation in terms of how scientific knowledge comes to be **embodied**, how biology is seen to be authored, and how in turn such acts of creation are protected as forms of property. Dolly’s coming into being disrupts the traditional template of genealogy: she was born from a new kind of cellular assemblage, in which donor cytoplasm effectively “reprogrammed” her nuclear DNA to “go back in time” and become newly embryonic. Dolly’s biology is as cultural as her ontology is historical, and she is part of a number of new animal kinds, or breeds, which instantiate larger changes in what Foucault denominated “the order of things” connecting life, labour and language. If Dolly were a sentence, we would need a new syntax to parse her, because her counterfactual existence troubles existing grammars of species, breed, property, and sex.

These troubles are not new – indeed many of them are quite ancient: like other animal forms of live-stock, Dolly embodies a commercial purpose written into her flesh. With Dolly, however, genealogy is reconstituted as a unique and unprecedented conduit for the production of biowealth, and she thus requires some altered templates of theoretical explanation to address the significance of her making, her marking, and her marketing as a successful product.³ Like older breeds, Dolly was created to explore new possibilities of making animal reproduction more efficient. In the process, she has altered the landscape of animal reproduction far more than anyone imagined possible.

“Viable” is an important word to describe Dolly in several senses. She is viable in the biological sense of being capable of life outside the womb, as in a viable new-born. She is also viable in the wider sense of being capable of success, or continuing effectiveness: she is viable in the corporate sense of a viable plan or strategy. Her existence confirms the viability of a particular

³ Although Dolly clearly continues a long tradition of animal breeding for human purposes, and thus is hardly unique for embodying human technical and discursive markers, this paper is less focussed on such continuities, instead seeking to articulate the ways in which cloning comprises a distinctive moment in animal manufacture. Another chapter could be written in which this distinctiveness is not the central focus, and a reverse set of claims about Dolly’s links to historical traditions of animal breeding are emphasised

scientific technique, the technique of cloning by nuclear transfer using fully differentiated adult cells, which was not believed to be biologically possible until she was born. As a viable offspring, Dolly confirms the viability of a merger between corporate sponsorship and research science. It is the successful merging of all of these meanings of "viable" that Dolly both embodies and symbolises: she represents the viability of a scientific technique, and of a corporate strategy, through her existence as a viable offspring. Her ability to survive, to function normally, and to reproduce naturally guarantees other kinds of viability: the viability of man-made life, for example, and the viability of the stock options of her parent company, PPL therapeutics, who financed her creation. Dolly is live-stock in a very overdetermined sense: she is not only viable as a single animal, but as a *kind* of animal, a new commodity species of what might be described as breedwealth.⁴ Above all, she is a newly-viable form of genetic capital, in sheep's clothing.⁵

In an era defined by the emergence of biowealth as the ultimate futures market, Dolly's birth is yet further confirmation of the means by which biological reproduction can become an engine of wealth generation and capital accumulation. Cloning and cell fusion have become increasingly significant means of reproduction in an era of polymerise chain reaction, immortal cell line banking, and genomic libraries. Dolly is owned as an individual animal, much as any farmer owns livestock. But she is much more valuable as an animal model for a technique that is owned as intellectual property, by means of a patent which covers the technique of nuclear transfer.⁶ In addition, ownership of Dolly involves the production of what might be thought of as new forms of biological enclosure, that is by the refinement of specific biotechno-

⁴ The ability to control animal breeding is one of the main definitions of domestication as applied to livestock such as sheep, cattle, goats and pigs. Human control over animals, often expressed as dominion, has been linked to wealth generation since the emergence of what are now called breeds, or breadlines. Breedwealth is a term which emphasises both the commercial motivations of "the breeder's hand," and the intensification of commercial interest in cellular and molecular biology applied to animal reproduction.

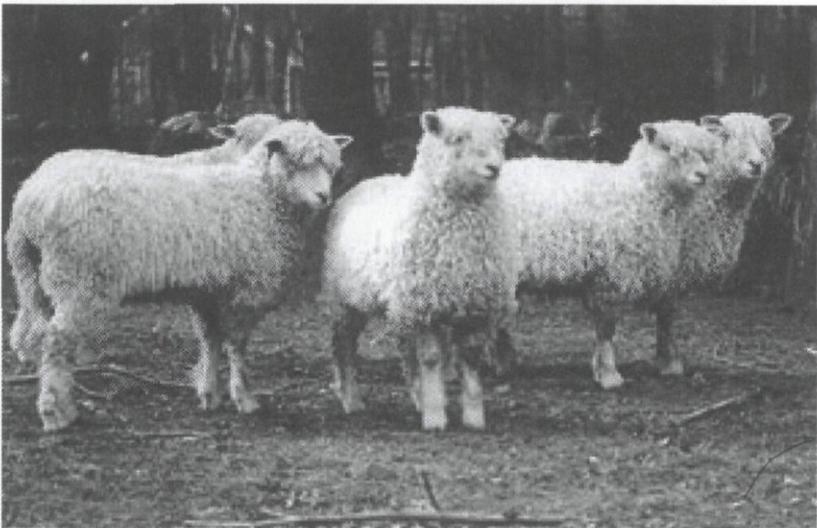
⁵ Part of Dolly's parent company was purchased in 1999 by the company Geron, who specialise in medical applications of cloning and have developed techniques for stem-cell amplification aimed to provide replacement organ tissue. This application of cloning by nuclear transfer, and its potential use as a form of assisted conception, are the most likely means by which "human cloning" will be inaugurated.

⁶ Dolly's creation is covered by two patent applications filed by Roslin Institute, PCT/GB96/02099, entitled "Quiescent cell populations for nuclear transfer" and PCT/GB96/02098 entitled "Unactivated oocytes as cytoplasm recipients for nuclear transfer." These applications are filed in most countries in the world and cover all animal species, including humans. Roslin Institute's policy is to license its patents by field of use.

logical pathways which reliably deliver certain kinds of functionality. For example the means of reactivating the recombined cells out of which Dolly was made involved identifying the significance of particular stages in the cell cycle, and learning how to manipulate these stages using electricity. The ability to “enclose” distinct components of the emergent biotechnological toolkit as private property thus involves a combination of skill, ingenuity, secrecy, and legal instruments such as patents, in order to create new forms of biowealth. Anthropologically, such alterations in the fungibility of animal genealogy pose questions not only about the production of new forms of genetic capital, but about the very basis for distinguishing among animal kinds – a question that in turn leads back into familiar questions about the connections between so-called “biological differences” the formal categorisations based on sex, gender, kinship and descent.

Genetic Capital

In the past, as today, the profitable reproduction of animals as live-stock has depended upon specific technological innovations and market refinements. Writing of the eighteenth-century livestock breeder Robert Bakewell, historian Harriet Ritvo describes an important shift through which this “master breeder” altered the ways in which prized animals came to be valued as individual repositories of genetic capital. It was the development of careful pedigree recording by Bakewell which enabled him to transform the livestock



Cotswold
sheep

market, so that he could effectively rent out his animals for stud duty. To bring about this shift in how animal reproductive capacity could be bought and sold, Ritvo argues Bakewell needed to transform the entire conceptual basis of livestock breeding. She claims that Bakewell accomplished this transformation through a shift in the definition of the genetic capital from the breed as a whole to the reproductive power of a single animal. She writes that,

Bakewell claimed that when he sold one of his carefully bred animals, or, as in the case of stud fees, when he sold the procreative powers of these animals, he was selling something more specific, more predictable, and more efficacious than mere reproduction. In effect, he was selling a template for the continued production of animals of a special type: that is, the distinction of his rams consisted not only in their constellation of personal virtues, but in their ability to pass this constellation down their family tree (1995, p. 416).

The shift here involves a part being enabled to stand for a larger whole. It could be described as metonymic in the sense that the individual comes to be so closely associated with the breed as a whole it can stand in its stead. More specifically, the shift is synecdochic, in the sense that *the substance from which it is made* can stand for an object itself, as in steel for sword. The accomplishment of this change in kind described by Ritvo, whereby a single animal could become a template for an entire type or breed, was accomplished through careful written records – that is, through the establishment of the studbook as a marketing device. The maintenance of such records enabled a differentiation to be drawn between male animals that were “good sires” and those who were not. In turn this differentiation enabled a reduction, of the male animal to a template of his kind. It also depended upon the redefinition of the breed, or breeding group, as a lineage. And it was these *conceptual* changes that enabled an exchange – of the stud fee for generations of careful breed selection.⁷

The point of all of this was its profitability. The successful enterprising-up of new property values in animals, and the establishment of a market in which to sell them, enabled Bakewell to increase by four-hundredfold within thirty years the value of his breeding livestock. It is no exaggeration to claim, as Ritvo does, that his approach changed forever how livestock breeding is both practised and conceptualised: “So complete was the conceptual transformation wrought by this redefinition of an animal’s worth, that at a remove of two centuries it may be difficult to recover its novelty” (1995, p. 417). It is also not irrelevant that these eighteenth-century breeding innovations estab-

⁷ By definition this is a very brief summary of Ritvo’s argument, whose work is of great importance in understanding not only the emergence of animal pedigrees, but of the importance of many domesticated species to Darwin’s models of evolution.

lished Britain as “the stud stock farm of the world,”⁸ a legacy still manifest in animals such as Dolly.⁹

As Ritvo observes, it is entirely commonsensical today that breeds are the result of careful selection, in-and-in breeding to improve the “line”, and the application of breeding principles to the improvement of stock by their owners. It is equally taken for granted that some animals are better breeders than others, and that this is a component of their monetary value. What her analysis reveals most compellingly is how much conceptual apparatus must exist in relation to the animal for its biology to emerge as “obvious” in this way, or indeed for the biology of a prized ram to emerge at all. A breed is thus a biotechnological assemblage, its very constitution a discursive formation, its genome a manifestation of the breeder’s art.

Dolly extends the uses of breeding in some important new directions. The definitive technology through which Dolly emerges as yet another kind of template for the breadline as a whole is the technique of nuclear transfer in the form of cell fusion through which Dolly was cloned.¹⁰ Dolly’s viability as an offspring has now authenticated this technique, and its profitability, much as the performance of Bakewell’s Dishley rams secured the viability of an earlier form of breedwealth in livestock husbandry, and Louise Brown’s viability confirmed the success of IVF (In-Vitro-Fecundation). Like the studbook, nuclear transfer also effects a reduction, of the animal to its DNA. But this time, there are several important differences. First, it is the female animal, and not the male, whose DNA serves as a template. And second, it is not the animal herself, but a laboratory technique which provides the means of reproduction. Let us pause to consider what these shifts entail in more detail, for they are, like those described by Ritvo, both technological and conceptual. In the industrial version of breedwealth established by Bakewell, the individual animal provided *both* the template *and* the means of reproduction: its genes *and* its own generative power were the package being sold. In the case of Dolly, *neither* her own genes *nor* her own generative capacity are valu-

⁸ As Cooper claims in his mid-century evaluation of Bakewell, “there are in fact only two breeds today not of British origin, namely Friesian cattle and Merino sheep, which have a truly international status” (1957, p. 90).

⁹ The Roslin Institute in Scotland, is itself heir to this same lineage, as a direct descendent of the Imperial Bureau of Animal Breeding and Genetics, created in 1929.

¹⁰ Dolly is not properly described as a clone, and the term “clone” does not appear anywhere in the *Nature* article by Wilmut, et al, announcing her birth. She is the result of a merger between the cells of two animals, not a “clone” in the strict botanical sense of an entity grown from a single cell of its progenitor (“cloning” comes from Greek for “twig” and is perhaps most accurately used to describe the way a gardener grows a new hydrangea from a single twig of a parent plant).

able. The *only* value she embodies is as an animal model for a patent application, providing living (and extensively DNA tested) proof that Ian Wilmut's technique can be successful. It is the viability of the means of reproduction used to make her, nuclear transfer technology, which is the source of new genetic capital – which is why it is nuclear transfer technology, and not Dolly herself, for which intellectual property rights were sought. In this sense, cloning by nuclear transfer enables genetic capital *to be removed from the animal herself* – and doubly so. This has significant consequences for how both reproduction and genealogy can be owned, marketed and sold, and also for what they mean, and how they are (dis)embodied.

These shifts have implications for both genealogy and gender. Very much in contrast to Bakewell's Dishley rams, Dolly is at a remove from the source of her reproductive value, which has, in a sense, been seconded to do service for (to establish the viability of) a technique of reproductive biology. Her own ability to reproduce is not an important conduit for the production of other animals, and in fact Dolly's own ability to produce lambs is merely a subordinated sign of her individual viability as a natural-technical product of corporate bioscience. Dolly was a successful trial run.

In sum, she is the cookie, not the cutter. PPL therapeutics is the world leader in transposing human genes into animals, in order to harvest peptides from their milk, in order to make new drugs. The aim of producing Dolly was to demonstrate the viability of a technique that *bypasses* her own reproductive capacity, which is too inexact. Cloning by nuclear transfer is useful because, unlike conventional breeding, it enables exact reproduction of an animal's complete nuclear genetic blueprint. In a sense, nuclear transfer decontaminates mammalian reproduction: we might say it eliminates nuclear waste. This innovation is valuable because it enables a new form of pure reproduction in higher mammals, removed from the genetic "noise" of the rut. The problem with conventional breeding, of course, is that it is very unreliable, inefficient, and thus costly. Every time a breeder mates a prized animal, the recombination of genes that is an unavoidable component of sexual reproduction introduces the equivalent of a genetic lottery: you never know what kind of match, or mismatch, is going to result.

Nuclear transfer removes this genetic gamble: it eliminates the genetic risk of sex, producing an exact replica of the desired genetic traits.¹¹ Through

¹¹ The exact genetic traits sought by PPL therapeutics are transgenic. The first cloned transgenic sheep was announced in July 1997, named Polly. Polly was created by "a version" of the technique used to create Dolly, namely the technique used to produce Megan and Morag, the sheep born at Roslin in 1996, using fetal rather than adult cells. The important point about Polly is not only that she carries the targeted human gene, but the

this means, it is argued by the Roslin team who produced Dolly, the precise genetic composition of prized individual animals be both preserved in perpetuity, and more efficiently reproduced in other animals. The possibilities opened up by nuclear transfer are indeed for any animal, male or female, wild or domesticated, or even extinct, to become a perpetual germline repository, a pure gene bank, because it is no longer only the gametes, the eggs and the sperm, which are necessary for reproduction to be viable. A single animal can be cloned to produce an entire herd of identical animals, which would otherwise take years to establish. These animals can also be improved with the addition of precise genetic traits, including those from other species. In sum, the value of nuclear transfer is so obvious it had to be invented. While compressing genealogical time, it also offers total nuclear genetic purity, in perpetuity, and under patent.¹²

Nuclear transfer technology thus offers a specific redefinition of breedwealth, or live-stock, by introducing new recombinant models of genealogy, species and reproduction. The principle of nuclear transfer is the exact reverse of Bakewell's contribution, and inverts what we might describe as the modern industrial model of breedwealth into its fragmented, post-modern successor project. If the studbook was a way to transform an animal's genealogy into a source of individual value, nuclear transfer is a way to depart from conventional genealogical spatiality and temporality altogether. Dolly's pedigree is removed from natural time, or the time of genealogical descent. Her mother is genetically her sister, as are her offspring.¹³ She was produced from the nucleus of a mammary cell, amplified from a frozen tissue sample taken from a pregnant Finn Dorset ewe who had been dead for six years. This nucleus was inserted into an enucleated "donor" egg cell from a Scottish Blackface sheep. The resulting embryo was gestated by two more sheep, the

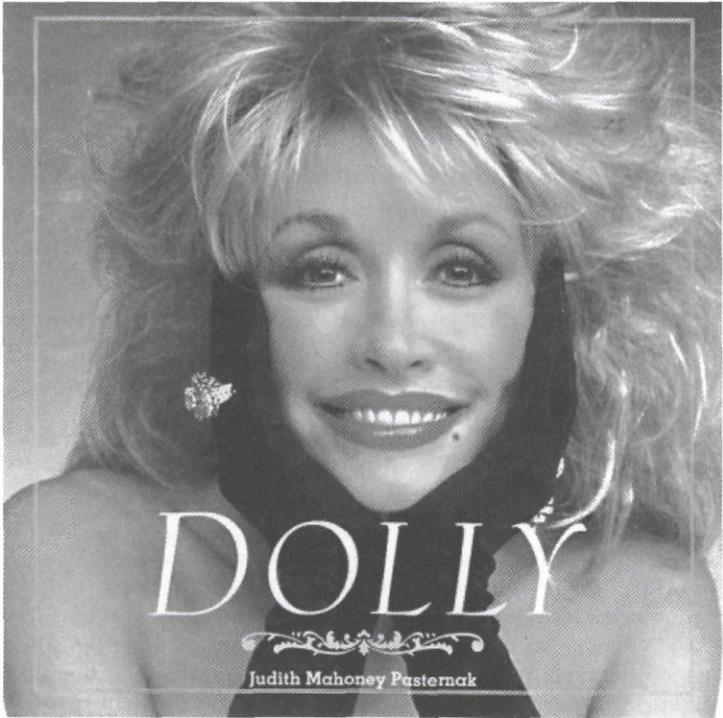
marker for it. The Roslin web pages explain that "earlier techniques have been hit-or-miss for mixing animal DNA but cloning should make that process more precise." Clearly there is little efficiency gain until cloning by nuclear transfer is significantly improved.

¹² I exaggerate deliberately, only to make the point that the promise of nuclear transfer corresponds with a commercial logic that is, by definition, hyperbolic. It is important to qualify many of the claims made about cloning and stem cells not only in terms of their low success rates and worryingly high levels of pathology, but also because it is likely to take many decades before any widely available therapeutic benefits are derived from this highly publicised area of scientific research.

¹³ Although it is tempting to use traditional kinship categories to play with Dolly's family tree, it is misleading insofar as these terms assume certain kinds of genetic relationality, at the same time they often depart from them entirely (such is the admirable flexibility of kinship categories in general). Dolly has both "her own" DNA, and is a genetically-distinct individual, at the same time that the "blueprint" from her genome was inherited from only one "parent."

second of which gave birth to Dolly. Dolly instantiates a new form of commodifying genealogy, *because she establishes a new form of genealogy altogether.*

So what are the implications of this enterprised-up genealogy for other naturalised categories, such as gender, sex, or species – all of which have depended upon the orderly brachiations of the unilinear, bilateral, and unified genealogical descent system Darwin envisaged as the real tree of life's? If Dolly is the product of a fertile union among several females – if she is the offspring of a kind of same-sex tissue merger – does this mean biological sex difference has become obsolete in terms of reproduction? Have we seen the transcendence of not only sexual difference, but reproductive difference as well? One reading of the Dolly episode might lead to the suggestion that maternity has triumphed over paternity, in a kind of recapitulation of the ancient matriarchy theories so influential in early feminism.¹⁴ And how appropriate that sheep



Dolly View

¹⁴ Philip Kitcher (1998), for example, supports cloning-for-families on behalf of stable lesbian couples who would like to have a child, and who could, if one partner donates the egg and the other the nucleus, more closely emulate the heterosexual ideal of conjugal and procreative unity (arguably not the most widely shared aspiration among lesbian couples). This example is only one of many in which we see how readily a technique often described as bringing about “the end of sex” is perfectly easily resituated within very normative family values.

are a very matrilineal species, each flock with its wise and woolly head ewe – just like in the film “Babe.” But the triumph-of-the-genetrix reading of cloning, which might be celebrated as the ultimate female-defined reproduction, is in tension with another possibility: that paternity has not so much been displaced as dispersed, into acts of scientific creation and principles of legal ownership. It may be the stud has vanished, but there are other father figures.

Dolly’s conception raises paradoxical implications for the meanings of maternity, gender and sex. For although the nuclear transfer technique is designed to produce female sheep from other female sheep, this occurs under the sign of familiar forms of paternity. The best transgenic ewes can be used to create the equivalent of studlines for entire flocks. Because all, or many, of their adult cells can be used for reproduction, they surpass even the much-celebrated heights of male sperm production, with every cell in their body potentially a new ewe. But these ewes are not analogous to super-studs *because their embodiment of a unique genetic template has been separated from their ability to pass it on*. The whole point of a studline derives from the idea of the unique genetic capital of a prized individual combined with that animal’s capacity to pass these traits on down the family tree.¹⁵ This was Bakewell’s contribution, as outlined by Ritvo, whereby the reproductive power of a specific animal could be sold as a template. Nuclear transfer technology anachronises this connection in the same stroke with which it eliminates conventional genealogical time, order, and verticality altogether.¹⁶

Such observations inevitably lead to questions about paternity and property, to Dolly’s “parent” company, and to her “scientific” father. Nuclear transfer is a device for seeding a corporate plan for the production of biowealth in the form of what Roslin describes as “bioreactors.” These bioreactors are the sheep that will function as living pharmaceutical producers, by producing valuable proteins in their milk. Dolly’s own now-proven reproductive capac-

¹⁵ As Ritvo explains, Bakewell used progeny tests to chart the performance of his studs to discover their “hidden” qualities. In addition to seeking purity of descent (preserved through in-and-in breeding), he sought what is technically known as “prepotency,” which Ritvo defines as “a heritage sufficiently concentrated and powerful to dominate the heritage of potential mates” (1995, p. 419). This is only one example of some of the many rather curious ideas about inheritance which continue to influence the breeder’s art. For example, even though Bakewell’s celebrated Dishley sheep did not prove to have much staying power as a breed, their best-known descendants, the Blue-faced Leicesters, are still primarily used to produce “tups,” young rams which are sold to be used for cross-breeding with other sheep.

¹⁶ It is tempting to note that the transgenic possibilities opened up through sheep-human combinations create a new kind of ewe-man genome initiative, but to suggest such a merger is to overlook the technical complexities that continue to beset this field of endeavour.

ity, in the form of her own viable offspring, becomes a kind of publicity stunt for the more important viable offspring known as nuclear transfer. Dolly's lambs provide further "proof" that cloning is a perfectly natural, sound and healthy means of reproduction (and what an attractive advertisement they are, timed perfectly to arrive each year at Easter). Ironically, Dolly's lambs do service for the scientific paternity of her own creation, which lies with Wilmut and his colleagues, who designed the blueprint of the technique that made her a viable offspring to begin with. Dolly's own maternity is as inconsequential in itself as are her healthy eating habits: just one more sign she is a perfectly sound animal. It might be said her maternity is a paradoxical stamp of approval for her thoroughly man-made viability.¹⁷

The meaning of paternity in the context of Dolly's creation is also evident in relation to the patent application that covers specific uses of nuclear transfer technology. The patent, after all, is a form of intellectual property protection which derives from the institution of copyright, first established by the Statute of Anne in 1710 in England, not far from Bakewell's farm either geographically or historically. As Mark Rose (1993) has suggestively chronicled, the establishment of copyright was explicitly argued by analogy to paternity. An author's original works were an inviolable possession of their creator, just as his children belonged to him because he was their procreator. Offspring of the brain and of the loins, argued prominent literary figures such as Daniel Defoe, derive from individual acts of creation, and must be protected as such. "Plagiarism" derives from the Latin word for kidnapping.

The invisibility of the maternal in such an argument directly anticipates the situation with Dolly. Defoe's argument that authors are essentially the fathers of their texts comprises a fantasy of male-birthing from which the maternal is excluded. It is an exclusion that recalls a phrase in Zora Neale Hurston's ethnography, *Tell My Horse*. Hurston describes the use of the expression "the rooster's egg" to describe children of white fathers and black mothers who were defined as "white" by virtue of their paternity.¹⁸ The subordination of maternity in the attempt to secure racial privilege is mocked by the figure of "the rooster's egg", marking this denial of maternity as an absurdity, a fantasy, and a lie. The invisible, or subordinated, maternal in the context of copyright was directly paralleled on Bakewell's farm, where the female animal was irrelevant, and only the male line "counted" for stud fees. Dolly's

¹⁷ Dolly is herself better known for stamps of disapproval, the standard threat gesture of the ewe. From the beginning treated with special care, Dolly is reported to be well aware of her stature, and to respond with an irritated stamp of the hoof to transgressions such as inadequate dinner.

¹⁸ This is also the title of a collection of essays by Patricia Williams (1995).

subordinated maternity thus repeats this longstanding pattern of maternal erasure, only in her case compounded by the explicit display of her recuperated maternity to confirm the skill of her creator. It is this original creator's skill, as an innovator, which is protected under the patent for nuclear transfer that Dolly authenticates as the viable offspring of pater Wilmut, also her genitor by technological proxy. To be patentable, an invention must be original, of utility, and non-obvious – and nuclear transfer is all of these, although, like much contemporary patented biowealth, it relies closely on designs that are “found in nature,” most notably the cell cycle. This form of ownership does not explicitly accrue to Dolly herself, who is but its means of realisation, or its proof. Dolly is herself owned under much more conventional arrangements, as personal property, in the manner that any farmer owns his or her sheep. The difference the patent protection secures in Dolly's case, however, is that the capacity for her maternity to be distributed has been enhanced. Her reproduction becomes partible: she is newly profitable because she is multiply divisible, and it is her divisibility which makes her newly fungible. In the same sense Hortense Spillers famously described the distributed maternity of female slaves, whose reproductive capacities their nineteenth-century masters could either sell or use themselves. The production of Dolly similarly conjoins commercial and biological enclosure, by isolating particular reproductive pathways, and creating a market in access to them. What is required in both cases is the separation of reproduction from genealogy – a feat particularly evident in cloned animals that are transgenics .

The popular association of cloning with slavery shares this recognition of the shame and disempowerment that occasions the loss of reproductive power.¹⁹ It might be argued that animals have long been owned in this way, their reproductive power part and parcel of their value. But, as Ritvo shows, this is not quite so simply and self-evidently the case. The capacity to own, to market, and to sell the reproductive powers of animals has changed quite dramatically over time, and has done so in close association with redefinitions of other forms of property, such as intellectual property. Moreover, the reconceptualisation of property is itself technologically-assisted, through inventions such as studbooks, pedigrees, and patents. Today, frozen cell lines, molecular biology and nuclear transfer are part of a wider set of conceptual

¹⁹ Interestingly, the use of the term “clone” to denote loss of reproductive propriety is also evident in the marketplace, where a clone is used to denote an illegitimately copied product, as in a “Gucci clone,” or the risk of illegitimate product use to markets, as in mobile phone fraud. Genetic markers are used by companies such as Monsanto to prevent “cloning” of their agricultural products in both the scientific and commercial sense as a means of protecting their reproductive rights.

and technological transformations in the capacity to own, to manipulate, and to profit from the reproductive power of animals, plants and micro-organisms. There is no other way to describe this than as an intensification of the politics of reproduction, and an enterprising-up of genealogy. And in the same way that capital is changing, so the new biology does not guarantee the same syntax it used to for other domains as well: what does it mean when genealogy can be remade as technique? What happens when the means of reproduction themselves can be owned under a patent? What is Dolly's proper gender, or sex, if instead of being born she was made?

Using the patented transgenic oncomouse as one of her guides, or figures, in *Modest Witness at Second Millennium*, Donna Haraway describes what she calls a "shift from kind to brand" (1997, pp. 65-6). Borrowing from, and mutating, Marilyn Strathern's work on kinship in *After Nature*, Haraway describes kinship as "a technology for producing the material and semiotic effect of natural relationship, of shared kind" (1997, p. 53). She describes kinship "in short" as "the question of taxonomy, category and the natural status of artificial entities" adding that "establishing identities is kinship work in action" (1997, p. 67). In the context of such denaturalised animate entities as oncomouse, Haraway argues that "type has become brand," and that the brand has become a kind of gender. The brand becomes for Haraway a kind of hyper-mark establishing kind and type in an *semantics of propriety* that is explicitly post-natural.

Haraway's shift from kind to brand thus describes the way in which the production of a certain type of animal, such as oncomouse, occurs out from under the sign of natural history and instead beneath its brand name. This interpretation thus literalizes the brand slogan of Dupont, "where better things for better living come to life," which Haraway first brought to her reader's attention in 1992, in the article "When Man™ is on the Menu" in which she claimed that the new cyborg animals of corporate biotechnology "will be literate in quite a different grammar of gender" (1992, p. 42).

Haraway's 1992 article appeared in the same *Zone* anthology, entitled *Incorporations*, in which Paul Rabinow argued that the new genetics represent the apotheosis of modern rationality, in that "the object to be known – the human genome – will be known in such a way that it can be changed." It was also in this article that Rabinow made the often-quoted prediction that,

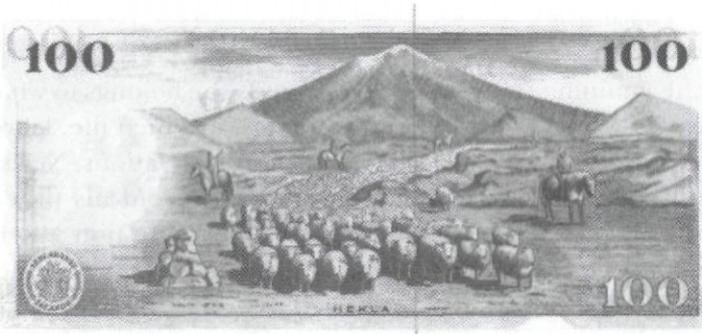
In the future, the new genetics will cease to be a biological metaphor for modern society and will become instead a circulation network of identity terms and restriction loci, around which and through which a truly new type of autoproduction will emerge, which I call "biosociality." In biosociality, nature will be remodelled on culture understood as practice. Nature will be

known and remade through technique and will finally become artificial just as culture becomes natural. (1992, pp. 241-2)

For Rabinow, the nature-culture split will disappear in a penultimate collapse of the very distinction out of which modernity emerged as a discursive condition in the first place.²⁰ For Haraway, nature is not so much displaced as reanimated, acquiring a new capacity to mark a different set of relations in the context of corporate technoscience, in which unnatural relations such as transgenics reappear as naturalised kinds through brands. There is no doubt Dolly is the founder animal for a new species of product, in which family resemblance is at a premium. She is not branded as such, but she secures a patent application through what might as well be her brand slogans: "Made in Scotland, Designed by Roslin, and Brought to You by PPL therapeutics." As the technology for making cloned transgenics improves, so will emerge successor generations of products in a commodity lineage of designer sheep. Global marketing strategies, such as those used by Intel, Nokia and BMW, borrow from familiar kinship idioms to provide analogies for the ways in which products are "related," but what is more revealing is how these analogies *can also travel back*. In other words, the brands and trademarks connecting products to their "parent company" stand in for shared substance, forming the basis of kin-relatedness as a familiar form of propriety-by-descent. These commodity descent lines are therefore instantiations of a different kind of substantial connection, which is established through trademark or brand as its mark. What is interesting is that, as Strathern argues, such analogies can be reversed: the traffic can make a U-turn. Hence, whereas genitorship has historically been the model for the naturalised propriety of copyright, we might argue that commercial propriety can now engender and naturalise paternity. Possession itself can figure technoscientific fatherhood.

What this suggests is that it is not only nature, but paternity which is "known and remade as technique," to redirect Rabinow's apt phrasing. Haraway's "shift from kind to brand" also points to this collapse, of the commercial and the paternal. Only now, as distinct from earlier episodes, it is *the means of reproduction itself*, and not merely its offspring, which paternity defines as its own. This made-in-the lab paternity may in fact perfectly instantiate what Rabinow describes as "the truly new form of autoproductio[n]" which is "the apotheosis of modern rationality." Like maternity, nature does not so much disappear as become a kind of trope in the context of late-twentieth century biotechnology (see further in Franklin, Lury and Stacey 2000). The

²⁰ In contrast, Latour argues this division was only an enabling fiction for modernity to begin with, hence his title claim that *We Have Never Been Modern*.



Sheep Money

same can be said for kinship and gender, which become much more like brand in their capacity to signify difference – through relations of enterprise and propriety rather than through relations such as genealogical descent. Now that animals such as Dolly are both born and made, they not only embody “nature remade as technique” but also “the shift from kind to brand” in their corporately owned and redesigned corporeality. In sum, I have argued here that the gender of the new genetic capital is very familiarly paternal, but that this repeat of an ancient tradition has taken a few new turns. For one, the means of reproduction have been removed from the animal, and placed under the sign of patent. For another, Dolly’s own maternity does service to the value of nuclear transfer as a means of both producing and protecting genetic capital. And all of this is possible, I suggest, because reproduction has been removed from genealogical time and space, becoming no longer either vertical or bilateral through new technologies. Life after Dolly is, in sum, both differently viable and newly profitable. I also suggest that Dolly shows us some important dimensions of what happens to gender when it is made not born. She helps us to ask what happens to what Monique Wittig calls “the mark of gender” when that marking occurs through branding, as a proprietary relation. In asking how brands are naturalised as what Haraway calls “genders,” there are important questions to be asked about how nature comes to signify in a post-natural culture. Does this model of gender simply give us more of them? If gender becomes a commercial equation is it easier to buy out altogether? Is cloning a form of gender trouble?

In terms of genealogy, the technique of nuclear transfer effects a 90-degree turn, whereby “descent” is no longer the equivalent of genealogical gravity. Instead, enterprised-up genealogy is newly flexible, so that it is more subject to redesign, and freed from the narrow trammels of species-specific reproductive isolation to become newly promiscuous: a mix ‘n’ match recombination, wistfully like alchemy.

Conclusion

Examining Dolly in this way suggests she belongs to what Foucault might have described as a new order of things, in which life, labour and language have been transformed in their constitutive relations. Never concerned with nature and culture per se, Foucault took from his predecessor Georges Canguilhem a historical and philosophical question about the relation of knowledge production to life forms, and indeed of epistemology to life itself. Always attentive to the constitutive power of knowledge in its many forms (disciplinarity, governmentality, classification, surveillance), and its myriad corresponding objects (prisons, clinics, museums, bodies, sexualities), a main theme of Foucault's writing concerned the transformation of consanguinity into population, and sovereignty into regimes of public health. Dolly perfectly instantiates this same constellation, *and simultaneously inaugurates its transformation*: she is, after all, part of a corporate plan to put human genes into animals in order to be able to derive pharmaceutical products from her milk, for profit. Her coming into being is as a new life form belonging to the future of medical treatment, wired to the human genome on the internet, in which the genetic specificity of the individual will replace the formerly generic model of the human used to develop new drugs in the past. Known and remade as technique, Dolly embodies changes in both knowledge production and governmentality. She is the viable offspring of the epistemological coordinates of the new biology in which it is less important to know what she *is* than what she *does*. Though it is now proven feasible, cloning by nuclear transfer is still poorly understood scientifically. The effects of imprinting in particular remain dimly recognised, despite being of utmost importance to genetic expression. An enormous discrepancy separates the Lego-like logic of molecular biology, its daunting technical language full of noun-verb hybrids for components that allow pieces to be put together and pulled apart, from the self-evident complexity of the relationalities out of which "genetic expression" emerges. The very term "genetic information" is a fiction, like "numeric value": it makes sense only if you take for granted everything needed to explain it.

What holds Dolly together is consequently not Foucault's order of things connected to the "life itself" he claims is the foundational concept of modern biology, but Lifeitself™, as in the Dupont slogan "where better things for living come to life."²¹ The new order of things instantiated through biotech-

²¹ I am borrowing back and remutating the term life itself from Haraway's description of it as "a thing-in-itself where no trope can be admitted," or as "a congeries of entities that are themselves self-referential and autotelic," like Dawkins' selfish gene, in sum, a kind of fetish (1997, pp. 134-5). I would like to argue it is not only the fetishism of life

nology has been vastly enabled by a loosening of patent law, which, from the early 1980s onwards have increasingly liberally allowed life forms to be patented not only when they are non-obvious inventions, but, increasingly in the age of genomics, simply when they are useful techniques. This mechanism of the nation-state to promote industry, the patent and its officers, and to connect labour and life into a productive force, is precisely aimed to fuel market speculation and encourage venture capital in a market dominated by multinational pharmaceutical giants, to create a situation one journalist has compared to the sixteenth century competition between France, England and Spain to claim the New World.²²

To say such changes have cultural implications seems a self-evident observation. The density and power of the capital resource, Lifeitself™, asks that it be understood as part of a historical transformation of a very distinctive kind. The splicing together of human genes with those of other species into a new *ars recombinatoria* of life forms which no longer belong to natural history or genealogy as we have known it means that none of the naturalised categories hold still in relation to what used to be seen as their given attributes. Is cloning by nuclear transfer sexual reproduction or not? How many parents does Dolly have? Kinship and gender, those serviceable anthropological digging tools, offer one way of thinking about what happens to these categories as kinds of kinds, or as the grammatical categories of a sociality understood to be glued together in some way by relationships established through reproduction and sex. In seeking to understand the recalibration of life itself in the context of biotechnology, the question has to be asked what happens when we understand genes as themselves the vehicle for cultural expression?

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itself as a commodity which is in evidence, but specifically its removal from genealogy, which has consequences for what propriety, enterprise, or commerce can connect.

²² Writing in *Wired*, journalist Michael Gruber suggests that: "The 21st century will be more like the 16th than the 20th, with biology standing in for the New World. The pharmas and the big chemical companies are the great expeditionaries D Cortés, Pizarro, de Soto, Raleigh, and so on. Government regulatory agencies are D what else? D the European imperial powers. The pharmas are after treasure, of course. The regulators want to keep control, which they express as an overarching social good D back then it was Defence of the Realm and Propagation of the Faith: today it's Public Health" (1997, p. 198).

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