

# Sheepwatching

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*'The parable of the Good Shepherd, in which Jesus likens himself to a shepherd who cares for his sheep, is one of the most common images found in churches of many denominations. Only rarely does the image of the Good Shepherd vary from the traditional one of Jesus holding a lamb and surrounded by other sheep.'*  
From: Ken Lueberrig and Robyn Burnett, *Gospels in glass: Stained glass in Missouri churches* (Pebble Publishing 2000).

I am grateful to four anonymous AT referees for comments.

1. At the time of writing the foot-and-mouth epidemic continues to spread, and it is not possible at this point to provide the kind of careful evaluation that will become possible once the crisis has subsided.

2. No less an historical authority than Fernand Braudel has claimed that sheep were integral to the emergence of the industrial revolution, not only because of the wool and cattle markets built around them, but because their ability to survive in the most extreme

Animals are brought into human social categories by a simple extension to them of the principles that serve for ordering human relationships. The method is to do the painstaking work of how the categories are used. (Mary Douglas, 1990:36)

I learned early on in my research for a book on Dolly the cloned sheep that almost every anthropologist has a sheep story to tell – if not several. Sheep stories offer snapshots of the simultaneously ordinary and complex imbrications linking humans and domesticated animals, and they are often used to reveal the paradoxical dimensions of these connections. The ways in which sheep are literally folded in to human social life are certainly not limited to rural, peasant or subsistence economies. One thing the foot-and-mouth crisis has shown very clearly is the global dimensions of local sheep farming, as well as the ongoing centrality of sheep to the British tourism industry, and their pivotal significance in linking the politics of the food chain to a wide range of issues, from human health to national prosperity. Sheep have become an animal category dense with paradoxical significance not only in the midst of the recent crisis, but through the widespread publicity surrounding the cloning of several sheep at the Roslin

Institute over the past five years – in a series of scientific advances that have frequently made front-page news, bringing us yet more sheep-shots in the daily papers. Watching sheep occupy these oddly prominent and pivotal positions in relation to public debate about food, health and the future of human and animal reproduction, I began to think about sheep as embodiments of shifting and uncertain relationalities. Sheepwatching was not an obvious place from which to observe new kinds of local-global connections, or new imbrications of life and death, or emergent politicized reactions to these shifts. I did not expect either to discover so many connections linking the uncertainties about cloning with what I now see as a closely related controversy about an older kind of sheep breeding in the context of foot-and-mouth.<sup>1</sup>

The fact that many of these connections are at times absurd, or surreal, not only because they are partial but because they are the site of significant disorientation, has also struck me as increasingly significant. Sheep, it seems, are a very good place at the moment to undertake the 'painstaking work' Mary Douglas describes as the task of parsing animal categories, to reveal some of the ways 'the principles for ordering human relationships' are being not only implemented, but transformed.

## Friday 13th, Lancaster

Good Friday's tabloids and broadsheets alike have all reproduced a distressing photograph of a newborn lamb covered in mud and trapped on an exposed hillside because of the restriction on livestock movements caused by the foot-and-mouth crisis. The outbreak of the disease

in the midst of lambing season has meant that for many farmers the anticipated period of seeing their flocks 'spring to life' instead has seen them put to death. The inevitable associations with the Paschal lamb in the week before Easter Sunday became more poignant, as pregnant ewes were shot, and young lambs succumbed to pneumonia within days of being born. The centrality of sheep-imagery to Christian iconography became increasingly explicit as church services around the country chose sheep-related hymns and prayers in solidarity with farmers unable to leave their homes, whose entire way of life was under threat from the slaughter policy.

Added to the biblical significance of sheep is their importance to a kind of English pastoral landscape, which is itself the product of a specifically English form of industrialization – namely the industrial revolution which emerged out of the sheep and wool markets that had established Lancashire and Yorkshire as the hub of a widespread trading network that even in the 17th century was already 'global' in its reach.<sup>2</sup> The current vector connecting a highly infectious microscopic virus and the global livestock industry turns out to be a very over-determined one, as ancient as it is complicatedly modern.



ROBYN BURNETT 1998

## Foot-and-mouth

The arrival of the 'plague' of foot-and-mouth raises complex questions about Britain's national livestock management strategy in a global economy; this drama has been broadcast to a world audience in vivid medieval scenes of pyres of animal carcasses. A literally visceral politics connecting the food chain to the tourism industry, the farming community, government ministries, and the national election continues to twist and turn unpredictably amidst ongoing uncertainty about whether the disease is truly out of control, or whether the ongoing mass cull of sheep, cattle and pigs will stem the tide of viral infection. The invisibly contagious threat of foot-and-mouth

evokes a sense of loss of control that has become increasingly familiar through salmonella, BSE, GM foods, and swine fever.

The resulting rearrangement of political faultlines, and complicated shifts in loyalty that produce altered senses of national belonging, or unbelonging, are evident in the emergent languages of popular resistance that utilize new kinds of core signifiers, such as locally grown organic vegetables. A very contemporary, yet inchoate, sense of risk is epitomized by the uncertainty of the food chain. A threatening and bewildering conglomeration of agricultural, corporate, and national economic forces into a global, 'MacDonald-ized', miasma seems to hang over everyday food choices, such as whether or not to eat beef.<sup>3</sup> The uncertainties that belong to these partial connections can be difficult to describe, in no small part because they are often absurd or surreal, such as the connections between American tourists, Herdwick sheep and Chinese restaurants.

environments, such as the Yorkshire Dales and the Pennines, enabled non-arable land to be reclaimed for agricultural purposes, essential to the increase in food supply necessary to support a rapidly expanding population in the North of England in the early eighteenth century (Braudel 1979:560).

3. José Bové, the charismatic anti-MacDonalds protester in France, became a sheep farmer in 1975 (Thomas Sanction. Superfries saboteur. *Time*, 6 December 1999).

4. Caryl Churchill is one of Britain's most original and eminent playwrights, whose previous work has satirically explored issues of class, gender and the history of British imperialism in plays such as *Cloud nine*, *Serious money*, *Top girls* and *Fen*. Churchill's *Faraway* was playing at London's Albery theatre at the onset of the foot-and-mouth epidemic.

5. The UK Ministry of Agriculture, Fisheries and Food.

6. Willis's reminder that in English the term 'animal' is not opposed to the category human, but encompasses it, is worth remembering in the face of the complex sheep symbolism at work in media representations of the foot-and-mouth crisis (Willis 1990:19).

7 Foot-and-mouth disease is only infectious to humans under very exceptional circumstances, and is described as comparable to flu for animals who suffer from it. FMD does not affect the quality of meat. It is, however, possible for the virus to be transmitted to other animals through infected meat, and also through the transport of live animals, who may carry the virus undetectably. The maintenance of a country's disease-free status is thus an economic policy based on how infectious the disease can be, and the diminished production levels which result from FMD infection, which, as is currently the case in Britain, may not only become widespread, but, if not completely eliminated, may become endemic.

8. Noëlie Vialles' comprehensive study of French abattoirs, *Animal to edible* (1994), provides a detailed account of the complex system of avoidances at work in the transformation of animal flesh into meat.

9. I am expanding here slightly on Strathern's descriptions of literalization (1992a, esp. p. 5) which often refer to analytic practices, such as the model of social construction. The broader point for Strathern, however, is relevant here too insofar as the process of making explicit certain kinds of connections inevitably also produces forms of displacement: a previous set of connections, once literalized, is superseded by the connections necessary to make



# CARNAGE

## 25 million animals are facing slaughter as foot-and-mouth epidemic turns into a national catastrophe

FULL DRAMATIC STORY AND PICTURES: PAGES 6 & 7

DAILY EXPRESS 24 MARCH 2001

### *Faraway*

No better portrait has yet been created of these absurd connections than Caryl Churchill's *Faraway*, the most recent play by one of Britain's most distinctive contemporary playwrights. *Faraway* presents a dystopic, semi-narrativized portrait of lost horizons in a globally militarized era, in which it is difficult to determine where you stand.<sup>4</sup> The front lines are tellingly blurred in the following account by Joan, one of the play's three characters, of her return journey to her home countryside; her testimony brings *Faraway* to an ambiguous close.

Joan: ...It wasn't so much the birds I was frightened of, it was the weather, the weather here's on the side of the Japanese. There were thunderstorms all through the mountains, I went through towns I hadn't been through before... It was tiring there because everything's been recruited, there were piles of bodies and if you stopped to find out there was one killed by coffee or one killed by pins, they were killed by heroin, petrol, chainsaws, bleach, foxgloves, the smell of smoke was where we were burning the grass that wouldn't serve. The Bolivians are working with gravity, that's a secret so as not to spread alarm. But we're getting further with noise and there's thousands dead of light in Madagascar. Who's going to mobilise darkness and silence? That's what I wondered in the night. By the third day I could hardly walk but I got down to the river. There was a camp of Chilean soldiers upstream but they hadn't seen me and fourteen black and white cows downstream were having a drink so I knew I'd have to go straight across. But I didn't know whose side the river was on, it might help me swim or it might drown me. In the middle, the current was running much faster, the water was brown. I didn't know if that meant anything. I stood on the bank a long time. But I knew it was my only way of getting here so at last I put one foot in the river. It was very cold but so far that was all. When you've just stepped in you can't tell what's going to happen. The water laps around your ankles in any case. (Churchill 2000: 37-38)

Amidst scenes of the white-suited slaughtermen from MAFF<sup>5</sup> with their rifles, standing beside acres of dead sheep, reports that BSE prions may be spread by the smoke from burning cattle pyres, and xenophobic rumours about infected pigswill affecting trade at Chinese restaurants – we could easily be in a scene from *Faraway*, unsure about



infection of the footpaths. Speaking as if in character, a woman from the Duddon Valley was quoted in *The Guardian* threatening to take direct action against MAFF's 'deceitful' slaughter policy: 'I've got a motley crew of animals. They will not get them. I've got chains, superglue, vicious geese, barricades and I'll lock myself up with them in my kitchen' (cited in Gillan 2001:3).

### Sheepwatching

One thing is for certain: sheep have rarely been so often depicted on the front pages of the nation's press, or on the evening news.<sup>6</sup> Foot-and-mouth has shown us that sheep are not only practically everywhere in Britain, but that they continue to provide a vital connection linking people, animals, the land and capital. Once as unremarkable as hedgerows, sheep have assumed a prominently visible role as doppelgangers for a confused citizenry, wary of scientific experts, mistrustful of government ministries, and beset by strange diseases. It is the very ordinariness of sheep that enables them in their new role as woolly canaries to demonstrate the risks of Britain having become, as members of the Soil Association claim, 'the Petri dish of the world'.

### Reproducing the future

The familiar take-home question of foot-and-mouth is whether over-industrialization of animal production is itself toxic – not only to animals but to farming as a way of life. We are forced to ask whether cheap food is in fact much more expensive than it seems. The foot-and-mouth crisis makes very plainly apparent the true requirements of the food chain, and in particular it showcases the brutal necessity of an efficient machinery of death for the economical production of life, or at least 'live-stock'. The goal of reproducing the future British livestock animal as disease-free has become a crisis of legitimacy, because it poses the paradoxical question of whether the only way to

# Brown puts his foot in mouth

● Farmers' fury at plan to kill one million healthy animals ● Minister causes alarm with cattle gaffe



The Daily Telegraph caption: 'Doomed: up to a million sheep, pigs and goats that have not shown symptoms of foot-and-mouth could be killed in the worst affected areas of the country to try to curb the spread of the disease, the government said yesterday'.

it differently visible.

10. An impressive account of the enclosure of the Scottish Highlands is provided in John Prebble's *The Highland Clearances* (1963). The most comprehensive account available of the history of sheep-breeding on a global scale is by M.L. Ryland of Penecuik, Scotland, entitled *Sheep and man* (1983). For a detailed account of Bakewell's methods of livestock improvement, and in particular his refinement of the Dishley Leicester sheep, see Ritvo 1995.

11. For a thoughtful exploration of some of the paradoxes presented by cloning, and how these recapitulate familiar kinship questions, see Edwards 1999b.

12. Ian Wilmut has argued that Dolly introduces us to 'the age of biological control' (Wilmut, Campbell and Tudge 2000). By this he means her birth confirms new powers to re-author biology. The legislative and regulatory control of cloning is also of great concern to government and industry, precisely in order to avoid the kinds of anxieties produced by foot-and-mouth 'infecting' areas of biomedical research such as human therapeutic cloning (Franklin forthcoming).

13. In the 'risk follows risk follows risk' chain reaction that is the consequence of a logic favouring the production of new technological solutions to repair the damage produced by previous technological 'improvements', we can easily imagine new cell lines producing cures for CJD, while introducing yet other

achieve a viable future for sheep farming is by maintaining access to the international markets that brought these animals into being to begin with – so they could be profitably sold – and in aid of which they are now instead being slaughtered in a bizarre animal sacrifice intended to preserve animal purity. A disease which is harmless to humans, and which does not even harm the sheep very much,<sup>7</sup> unconvincingly requires the spectacle of a mass cull, producing anguish for the farming community because animal reproduction is primarily, but never fully, driven by the logic of profit. The farmer weeping next to the blazing pyre of dead sheep is a complicated portrait of a breach in the relationships between animals and humans that are ordinarily maintained through a much more normalized machinery of animal death.<sup>8</sup> These disturbing scenes of burning carcasses make explicit the realities industrialized farm production usually manages to render invisible, and the palls of smoke that hang over the Cumbrian fells haunt such scenes of trauma with questions about whether this form of market protection really makes any sense.

## The politics of the food chain

Foot-and-mouth, like BSE and salmonella, swine fever and the GM food debate, reproduces once again the sensation that the food chain is currently a scene of crisis and confusion. This strikes home because food is a commodity we consume not only as purchasers, but as eaters: this is about breakfast, lunch and dinner. The politics comes to us on a plate. It is about bacon, biscuits and burgers. It is about supermarkets such as Sainsbury's, and it is about the National Farmers' Union, the Consumers' Association and MAFF. The politics of the food chain unite very personal and domestic activities with broader questions about morality, governmentality and the future. The present crisis is only one of many such scenes of disarray in which we can look for changes in some of the fundamental categories through which the future is reproduced. Because reproducing the future animal turns out to be about the reproduction of much else besides, including the very terms we use to understand what is going on.

Foot-and-mouth poses a crisis of reproduction not because it threatens the animal or the germplasm, but because it is lethal in another sense: economically. Access to lucrative global markets for both live animals and animal products is regulated through a division between countries that maintain a disease-free status, such as Britain, and those that don't, such as Argentina. The ban on imports of pigswill instituted shortly after the outbreak of foot-and-mouth was discovered was an attempt to eliminate the route of contagion between these two meat sources, via which the current epidemic is believed to have arrived. The policing of pigswill is an attempt to keep the global out of the local in order to preserve national uncontaminated status. But the global has got into the trough, the

infection has travelled to sheep, and the rest of this tragic story is hardly ever off the evening news.

Thinking about the reproduction of animal bodies at the present time in Britain raises uncomfortable questions about how certain things just don't add up to a very coherent picture. This confusion could be understood as a process Marilyn Strathern has described as literalization – a process of things being made explicit in ways that change the conditions of how they come to appear as obvious, self-evident, or 'real'. Meat production is an interesting scene of literalization, because it is culturally organized through a series of reframings, or re-contextualizations, whereby an animal on a farm becomes a carcass, and eventually a meat product shrink-wrapped in clingfilm. Now, however, new literal facts have been introduced into public understandings of meat production, such as the fact that cows have been fed the carcasses of other cows, which in turn has introduced a potentially lethal source of infection in the form of BSE (with which foot-and-mouth disease is often confused). Literalization not only describes a process of cultural change, or a way of understanding it: literalizations produce cultural effects by realigning the connections that produce meaningful differences.<sup>9</sup> Pigswill contaminated by airline food, like dimpled chads compromised by mechanical error in the last American presidential election recounts, make new connections explicit in ways that are not only partial, but absurd.

## Absurd connections

These are the kinds of connections Churchill makes in *Faraway*:

Todd: The Latvian dentists have been doing good work in Cuba. They've a house outside Havana.

Harper: But Latvia has been sending pigs to Sweden. The dentists are linked to the international dentistry and that's where their loyalty lies, with dentists in Dar-es-Salaam. (Churchill 2000:31)

One interpretation of the absurdity Churchill depicts is that her 'faraway' connections combine a sense of the familiar with the partial – in the sense of being connections that are generically and stylistically (that is, formally) recognizable, while being provocatively incomplete. The connections are also gaps. The possibilities these gaps invite blur the relationship between what is real and what is imagined, between rumour and truth – a condition often described as definitively postmodern, 'global', or as an effect of the 'risk society' (Beck 1992). I read an article that described Dutch farmers sheltering their sheep from a flock of geese that had probably flown over from Britain. It could be another scene in *Faraway*:

Todd: The veterinarians are taking sheep from the fields: they have a tent near the market where the army butchers kill them with steel rods. The farmers have run out of disinfectant. The government is opposed to vaccination. The geese are carriers and are flying to Holland.

Harper: The virus is attracted to rubber. I've stopped driving my car. You can smell the fires burning near Halton. They have been burning for days. The Ministry says it's from Argentinian beef fed to the army.

The food chain is a good place to look for unsettling connections not only between the local and the global, or life and death, but between the global and the personal in terms of what we eat. Contextualizing food choices are new knowledges about the food chain which make explicit both literal and more ambiguous connections, not only in terms of meat production, but within a wider politics linking the futures of agriculture and the countryside to the role of supermarkets and government ministries. The foot-and-mouth crisis makes explicit not only the circuits of connection linking people and sheep, tourism and farming, or a virus and the Common Agricultural Policy, but how

*Megan and Morag. Born at the Roslin Institute in the summer of 1995 near Edinburgh in Midlothian, Scotland, they were both carried to term by a surrogate mother. They were not produced from the union of a sperm and an egg: their genetic material came from cultured cells originally derived from a nine-day-old embryo. That made Megan and Morag genetic copies, or clones, of the embryo.*



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these connections produce piles of burning dead sheep. In other words, both the scale and the stakes of the connections linking farming policy to a host of global factors have become highly visible, have been made very explicit, and have been literalized by foot-and-mouth.

#### Let us now praise famous sheep

I was inevitably reminded of these connections in April of this year at the conference dinner of the annual Human Genome meeting in Edinburgh, which took place in the foyer of the Royal Museum. Next to more than a hundred of the world's leading genetic scientists, a newly installed display case featured Morag, the first of the Roslin sheep to be stuffed for posterity. Clearly dead, Morag exudes the vitality of the specimen well preserved by taxidermy (a skill for which the Museum is widely admired). One of Dolly's fleeces is also displayed, anticipating the animal herself, who is already promised to the Museum, although unlikely to arrive any time soon. When I visited the display case earlier in the day, two children were asking their mother if Morag had died of foot-and-mouth disease.

Food is not the only site in which new kinds of connections ask for urgent moral and political attention, or in relation to which sheep have acquired a very prominent public profile. Health has also become a complicated site of governmentality, beset by conflicting local and global forces, which test the limits of commercialization in the name of public service. The most famous sheep in the world, Dolly, is literalizing these connections through a redefinition of health that offers useful contrasts with foot-and-mouth. Here too, life and death are very much in the balance, the local and the global take sheep-form, and the results connect very personal and intimate issues with much wider forces at work. In Dolly's, or Morag's, case, the redesign of the biological is remaking the global, as well as the personal, by rewriting the rules of genealogy as well as sheep breeding.

The old sheep technologies were based on successful commercialization of the germplasm through selective breeding, famously 'improved' by Robert Bakewell in the eighteenth century, and exploited by other 'improvers' through, among other mechanisms, the enclosure of the Scottish Highlands.<sup>10</sup> As sheep breeding was instrumental to the emergence of the industrial revolution, so too it was

integral to Britain's expansion as an empire, as the nation became 'the stud stock capital of the world' by exporting its breeding livestock to every corner of the globe. The varied ecological conditions of the British Isles, and their boundedness, made for a unique system of sheep interbreeding that establishes Britain still as the world hub of sheep farming. Cumbria, the backbone of this intricate system, is one of the areas hardest hit by foot-and-mouth, threatening the future viability of a highly mobile system of sheep breeding which has existed for centuries.

While older methods are under threat, however, biotechnology has introduced new mobilities into selective breeding. New breeding methods developed by British agricultural facilities, such as the Roslin Institute in Scotland (a direct descendant of the Imperial Bureau of Animal Breeding), are redefining the relationship between capital and the management of animal germplasm. It is no coincidence that Dolly is a sheep, not only because they are readily available in large quantities to facilities such as Roslin, or because they are inexpensive, but because the very hardiness that enables sheep to inhabit remote and harsh environments also makes them highly suitable for experimentation. The most numerous sheep in Britain, the Scottish Blackface ('Blackies'), belong to a tough mountain breed which weathers surgical procedures such as egg recovery with the same impressive fortitude that makes them capable of wintering so well in the most remote and exposed environments. These sheep are the bread and butter of large animal surgery units like Roslin, which is one of the largest such facilities in Europe.

#### Making 'smart' sheep

Unlike the tragic tale of foot-and-mouth, which highlights so many absurd, illogical and distressing connections, the success story of Dolly the sheep is celebrated as a narrative of scientific progress in the service of economic growth and improved human health. Whereas foot-and-mouth foregrounds a loss of control, the Dolly story highlights its opposite, emphasizing new capacities to rewrite genealogy with unprecedented molecular precision. It is not as if the Dolly story lacks absurd connections: much of the humour surrounding cloning makes these evident.<sup>11</sup> For example, it is paradoxical that Dolly is a sheep, given that sheep 'naturally' look very much alike to humans, and it is ironic that she is a singleton, despite signifying the threat of multiplicity (see Battaglia 1995). However, in contrast to foot-and-mouth, the paradoxical, partial and absurd connections in the Dolly story are more muted: while cloning poses the threat of a future crisis (especially in the form of cloned humans), it is at present seen to be 'under control'.<sup>12</sup> Quarantined in her pasture in Scotland, surrounded by foot-and-mouth infection, Dolly and the other Roslin animals are literally isolated in a manner that neatly recapitulates the strict separations required to preserve a faith in 'biological control' against contamination from its opposite, in the form of loss of control. After all, foot-and-mouth is not only a crisis affecting the farming community, or tourism. At stake, and revealed in full colour pictures, are anxious questions about the reliability of scientific expertise in the face of the inherent unpredictabilities and risks associated with the industrialization of life itself.

#### New life forms

The technique that was used to make Dolly, of cloning by somatic cell nuclear transfer, was originally conceived as a method of selective breeding, a refinement – a way of more efficiently producing transgenic animals, in particular those with human genes. In making Dolly it was discovered that new kinds of biological pathways could be opened up, and these pathways have quickly been con-

unknown bio-risks (in the same way as GM foods have in part been introduced to mitigate the failures of the so-called 'Green Revolution'). The reproduction of bio-risk is thus an integral component of the reproductive futures brought into being through the redesign of the biological, now as in the past.

14. For a very clearly written and detailed account of the techniques used to produce Dolly, see Wilmut, Campbell and Tudge 2000. See also the Roslin web pages: [www.roslin.bbsrc.ac.uk](http://www.roslin.bbsrc.ac.uk). Dolly the sheep is safely quarantined in Scotland, is in good health, has not aged prematurely, and is unlikely to be culled due to her unique scientific importance.

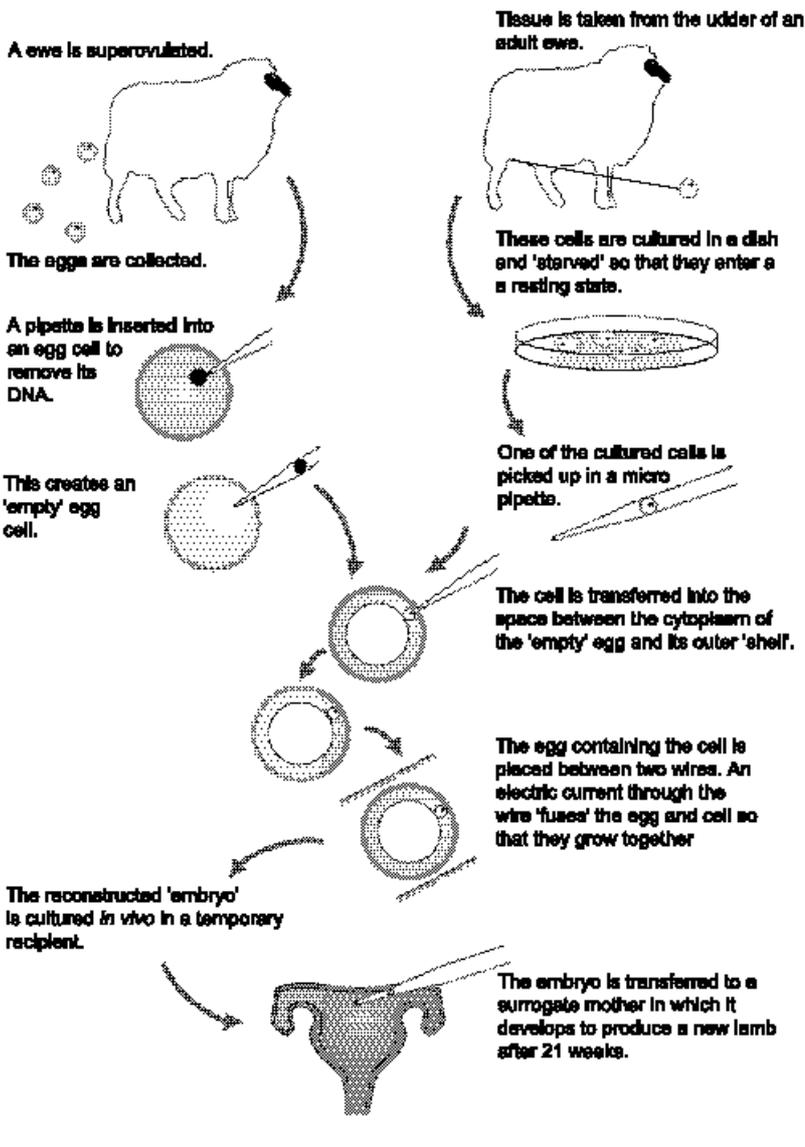
15. We could call this 'differentiation without loss', which raises a very important set of questions about the economy (loss) of (sexual) difference widely perceived as the threat of cloning – often expressed, paradoxically, as a fear of loss of individuality. The association of the clone with the homosexual, or the (criminal) fake (as in the reference to brand name imitations as 'cloned' merchandise), indicates an anxiety that restages a very familiar (Euro-American?) habit of conflating biological models of reproduction with cultural models of identity or personhood (cf. Strathern 1992a & b).

16. The success of the PPL experiment to 'reprogram' bovine cell lines was announced by its Managing Director Ron James at the British Fertility Society meetings in London on 23 February 2001.

17. After all, it is of little use to have the genetic alphabet if no-one knows how to write a sentence, or has any grammar.

### (c) Nuclear transfer

This is the process that produced Dolly, the world's first mammal derived from the cell of an adult animal.



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Reproduced with permission from Robert Straughan's Ethics, morality and animal biotechnology (Biotechnology and Biological Science Research Council, 2000), p. 27.

18. The logic of function defines the order of things when the goal is to extend biotechnological possibility, rather than simply search for formal, natural, or other (uselessly static and now quaintly historical) principles. The epistemology of the new biology is distinctively performative. No-one needs to reach agreement about what a gene is in order to find it, mark it, clone it, splice it or harness its powers to produce another protein event more predictably.

19. It is important to remember how much the new biotechnologies have in common with very old techniques, most notably

verted into new industries of cell line production. These new life forms, immortalized cell lines, are linked to imagined future markets for human tissue, new methods of protein manufacture, and a host of other applications. This new form of linking the production of life-as-technique to capitalization opens up unprecedented questions about the future of both animal and human genealogy in the realm of human health technologies, just as the hyper-industrialization of farming poses challenging questions about bio-risk.<sup>13</sup>

To make Dolly, Ian Wilmut and his team inserted an entire adult cell into an enucleated egg to make a new kind of embryo. The adult cell they used had been taken from a six-year-old Finn Dorset ewe and made into a cell line which had been in storage, that is frozen, until it was, as the Roslin scientists describe it, 'cultured up' for use in the Dolly experiment. 'Culturing up' meant manipulating the culture medium to slow the cells down into near quiescence to prepare them for transfer. The egg cell, from a Scottish Blackface ewe, was also slowed to the same stage in the cell cycle, and the tiny adult cell was inserted into the much larger egg cell using handmade micro-pipettes and a micromanipulator. A shoebox-sized electrical device was used to send a current through the Petri dish containing the reconstructed cell in order to dissolve the wall

of the Finn Dorset mammary cell and effect a fusion. What was discovered through the eventual, and counterintuitive, success of this technique was that the powerful cytoplasm of the egg cell is capable of re-instructing adult DNA to 'go back in time' – to recommence biological development with its full complement of genetic potential. This is what was supposed to be biologically impossible.<sup>14</sup>

Before Dolly, it had long been assumed that cloning from an adult cell was impossible because it contravened a basic principle of developmental biology – that cells lose their early, so-called 'totipotent' capacities to become any cell as they specialize. In other words, it was assumed that in the process of becoming, say, a skin cell, the capacity to become a liver cell, or a hair cell, or a nerve cell is lost. This was assumed to be a consequence of the one-way linear trajectory of biological development, known as differentiation. Ian Wilmut initially described the technique used to make Dolly as 'de-differentiation'. That is to say, he understood that what the Dolly technique enabled was a de-differentiation of the adult cell, so that it could be re-capacitated to become any cell, or indeed all of the cells necessary to produce a viable offspring. This interpretation was radical enough in its contradiction of one of the elementary principles of biological development. But Wilmut has since gone further to suggest that de-differentiation is possibly the wrong description. He now wonders whether cells *ever fully differentiate to begin with*, or whether, in fact, they retain all of their original capacities, or most of them, *even when they specialize*.<sup>15</sup>

The likelihood that Wilmut is right to suspect that de-differentiation is a term that references an outdated model of biological development would seem to have gained greater credibility in light of the recent announcement from PPL Therapeutics (who are based on the same site as the Roslin Institute and provided backing for the Dolly experiment) that they have successfully produced beating heart cells out of skin cells, using bovine tissue. Like the Dolly experiment, this as yet unpublished research from PPL suggests that significant commercial possibilities are becoming evident through greater biological control over cell structure and cell function.<sup>16</sup>

### Dolly Mixtures

These experiments are part of a very broad process by which the emphasis on gene location and structure, which has driven so much biological research over the past two decades, is giving way to a model of downloading genetic functionality into cell lines – also known as post-genomics. This shift is also described as one from genomics to proteomics, that is, from the study of gene sequences and their locations to the study of the complex protein pathways through which genetic function is expressed.<sup>17</sup>

Post-genomic excitement is increasingly focused on new biological pathways that can be mobilized to offer a vast expansion in the control, or re-programming, of cell function. The emerging science of what is known as tissue engineering uses an explicitly constructionist language of building cell functionality into particular kinds of life forms – not only cell lines and transgenic animals, but artificial life systems, which increasingly overlap with more familiar kinds of biological organisms. We can think of Dolly in this context as a complex mixture – a Dolly Mixture, mobilizing an informatic idiom of genetic reprogramming to 'quicken' a new kind of built (cellular) environment that became viable through the techniques Roslin scientists refer to as cellular reconstruction. Dolly has a new kind of informatic, or virtual, genealogy, for which the adult cell is a kind of nuclear genetic CD, the egg cell is a kind of cytoplasmic rewriter, and the viable offspring is at once a print-out, a scientific proof, and a

# Put the country first, says Hague



THE DAILY TELEGRAPH, 29 MARCH 2001. PICTURE: JEREMY SELWYN

The Daily Telegraph caption: 'Death chamber: sheep being herded to slaughter in a tent at a disused airfield at Great Orton, near Carlisle, yesterday as army butchers were drafted in to help speed up the cull'.

domestic animal breeding, and how central agricultural innovation has been to the establishment of local, national and eventually global markets – as early as the fourteenth century. The corn and cattle trades are the core examples at the heart of Marx's theories of capital, and the foot-and-mouth epidemic which threatens to break the back of Britain's sheep-breeding industry demonstrates how much is still at stake in the connections between the management of the germplasm and national prosperity.

Battaglia, Debora 1995. Fear of selfing in the American cultural imaginary or 'You are never alone with a clone'. *American Anthropologist*, 97(4):672-78.

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new kind of mammal.

As in the past, complex linkages and techniques connect viable animals with viable markets – in Dolly's case through an emerging biotechnology sector devoted to exploiting newfound capacities to reprogram cellular pathways. The language of scientific representation in this fast-paced and highly competitive field references a hyperstack of industrial analogies drawn from engineering, computing, agriculture, molecular biology, and medicine. The new life forms are rewriting the rules of how germplasm can be commercially exploited, while at the same time they are also redefining what a life form *is* in terms of what it can *do*.<sup>18</sup>

## More immortal cell lines

In 1998, the patented techniques used to make Dolly the sheep were relicensed to the American pharmaceutical corporation, Geron, in a deal that involved a 25-million-dollar research funding partnership with the Roslin Institute under the auspices of the Biotechnology and Biological Sciences Research Council (BBSRC). Geron hopes to combine the Dolly technique with its own research into the mechanisms of cellular aging in order to create better immortal cell lines. Like the transgenic sheep that PPL Therapeutics describe as 'bioreactors', because they produce valuable human proteins in their milk, Geron hopes to make smarter cell lines that can produce tissue replacement therapies for a wide range of human medical applications. A heady vista of new market opportunities beckons in the space opened up by the new scale of biological control available through cellular and genetic recapitulation. The idea is that a person's own cells might be recapitulated to provide bespoke replacement tissue that is potentially life-saving in the event of major illnesses such as kidney failure, cardiac conditions, cancer, and a host of other disorders. These techniques are now known as human therapeutic cloning, and they effect an expansion in the use of cloning techniques to include human applications. In Britain, these techniques have already been debated in Parliament, and this is the only country in the world to have explicitly legitimated, that is, legalized, human therapeutic cloning.

The Geron-Roslin merger establishes reproductive rights in the cloning technique used to make Dolly through an exchange between the patent owners at Roslin and the licensee, which is Geron. The legal conduit, or pathway, of access to the patented Dolly technique is used to create new cell lines that promise to bring significant commercial remuneration in return. Life itself is being cultured up, and

enterprising up, in this exchange in complex ways that draw our attention to the boundary-making practices we might see as the open and closed footpaths that criss-cross the hybrid public/private landscape of the biotechnological. The exclusivity of access that Geron is afforded to the Dolly technique via a patent gateway protects the company from trespassers, while the open countryside the technique offers in terms of scientific exploration provides them with a wide field of competitive opportunity. The opening-up of the biological is thus tapered through legal regulations that govern its exploration, defining new acts of enclosure in the service of creating new markets. It is just another form of selective breeding, but the way the forces necessary to make this situation coalesce – legally, scientifically, technologically, commercially, *and genealogically* – is unprecedented. What has happened to patent law is inextricable from what has happened to biology.

## Contagious mobilities

Dolly may look like an ordinary sheep, but she has become a 20th-century icon because she embodies new biological possibilities that are at once astonishing and bewildering, while being all too familiar – a bit like sheep themselves. The difference between Dolly's mediagenic public profile and Good Friday's mud-covered lamb is precisely the difference between faith in biological control and its loss. Watching these polar opposites take sheep-shape offers an unusual standpoint from which to think about the ways in which the bio-technological can both hold together, and come apart.

Once infected swill had contaminated the troughs of the pig farm at Heddon-on-the-Wall in Northumberland, a chain of contagious effects ensued which can only be fully evaluated at some point in the future, after the current crisis has ended. What is clear, however, is that the foot-and-mouth crisis transformed one set of connections into another. Meat from Heddon-on-the-Wall transported to Cheale Meats in Essex became a vector of national catastrophe rather than an unremarkable commercial transaction, and the spread of infection has resulted in the controversial slaughter policy, which in turn has forced a major re-evaluation of British and European agricultural policy. It is the very mobilities required by global markets – thousands of 'sheep movements' – which enabled the infection to spread so widely which are now being re-evaluated, not least in terms of their sheer economic viability. In turn, the doubts that have been raised about agricultural policy have become linked to questions about the food chain, and to what might be described as an emergent politics of the supermarket through which new forms of consumer demands are performed as expressions of civic responsibility.

In the Dolly story, which has not come undone, and has not been infected, new biological pathways and mobilities are heralded with great enthusiasm, and are seen to be integral to the development of important economic markets in the biotechnology sector. These new global mobilities at the heart of the germplasm reproduce very well established connections between the selective breeding of domestic livestock and the creation of national and global markets.<sup>19</sup>

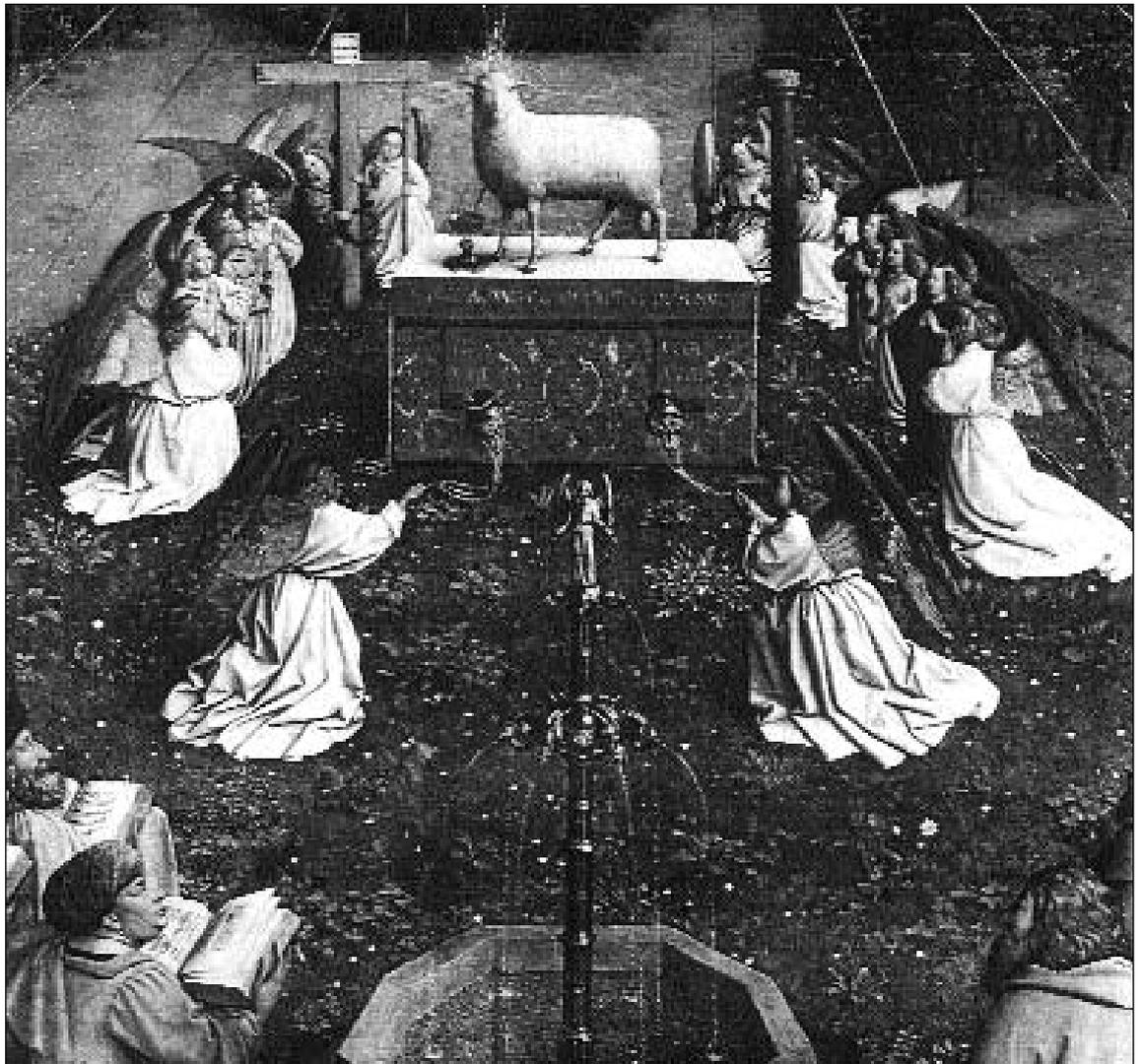
The task for which sheepwatching may continue to provide assistance in the future is that of gaining analytic purchase on developments which at once belong to, but also exceed, existing means of anthropological description or theorization. As appears to have long been the case for anthropologists, sheep offer a useful interpretive vantage point from which to view the interstices of social life from a different angle. This may be especially important to the interpretation of the new life forms that populate the global biotechnology industry. What anthropologists have only just begun to explore are the cultural values, and ways of



Top: Stone relief of Agnus Dei, the Lamb of God, 11th-century France.

Right: 'The adoration of the lamb', illustrating an episode in the book of Revelations. Detail from the central panel of the Ghent altarpiece by Jan van Eyck (finished in 1432). St Bavo's Cathedral, Ghent.

Bottom right: Christ on the cross with Agnus Dei, the sacrificial lamb as symbol of the crucifixion. Detail of a painting in Weimar, 1663-5.



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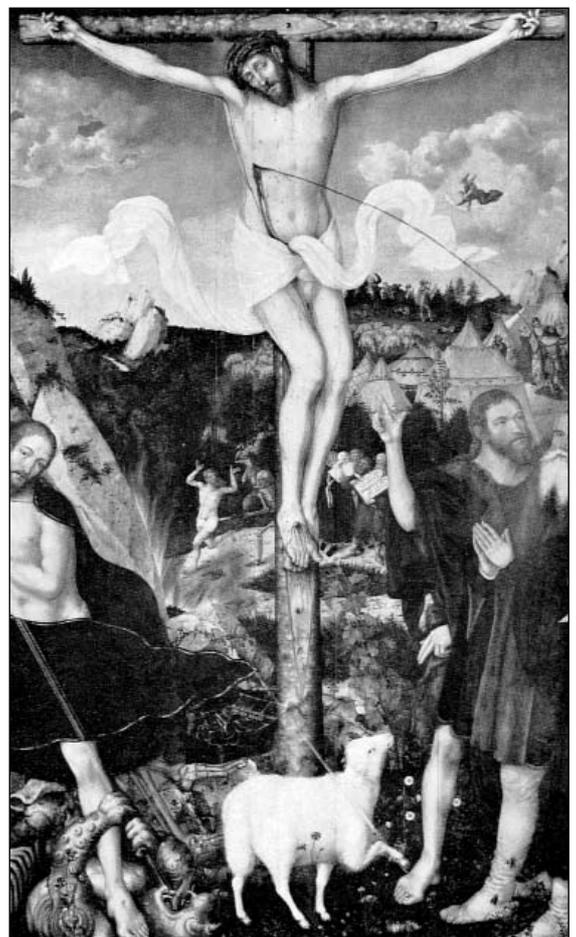
Wilmot, Ian, Campbell, Keith and Tudge, Colin 2000.

*The second creation: The age of biological control, by the scientists who cloned Dolly*. London: Headline.

life, at stake in the re-engineered connections that link sheep and human genes to cell lines and embryos, through knowledges and techniques of germline manipulation that are increasingly commercially driven. There is, in short, a broad anthropological question posed by the commercialization of the germplasm, which is about the ongoing industrialization and commodification of life itself, but is also about the future of human subsistence and human health at a fundamental level. Public scepticisms about food, health, and reproductive futures are highly volatile and convincing – as well as being global in ways that show us how very personal 'the global' can be.

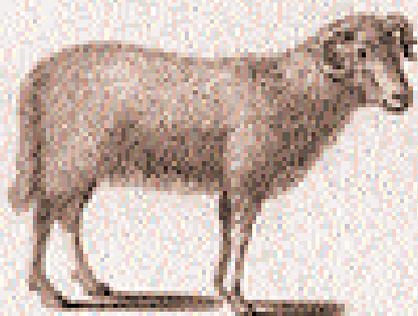
We perhaps see more clearly the questions Dolly poses at the level of how biology and commerce are being redefined when we consider their continuities with an earlier history of industrialization. The contrast between the celebrated Dolly story and the tragic tale of foot-and-mouth is indicative of the complexity of the encounter between a distinctive British history of sheepbreeding and the new global mobilities transforming its future. Both are stories about the intersection between specific biological pathways and the production of viable commercial markets.

The army and the sheep are performing a very odd choreography with the veterinarians and the possibly contagious geese, to the tune of a confused agricultural policy. Meanwhile, in her display case, Morag is looking very fit indeed. An important part of the question sheep are posing is about the connections that link animal genealogies to human futures through industrialization, redefining basic issues of health, subsistence and economy in ways that produce new forms of citizenship as well. Now that sheep have human genes, they may become even more interesting to think with, as well as to watch. ●

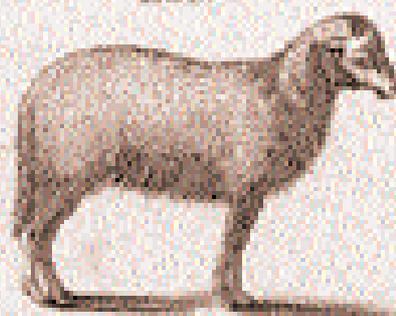


## OVES.

Common Ram.



Ewe.



Ewe.



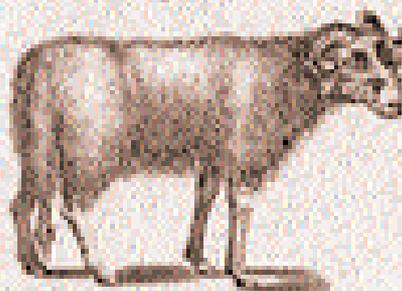
Spanish Ram.



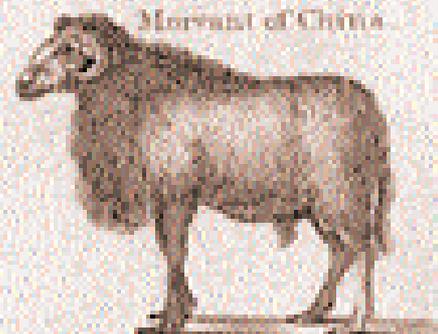
Iceland Ram.



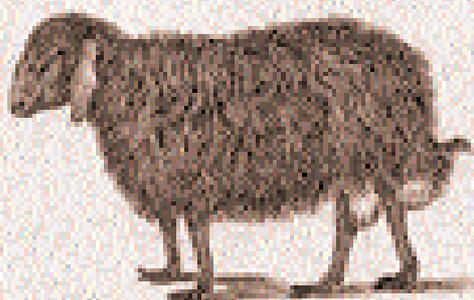
Barbary Wedder.



Mervant of China.



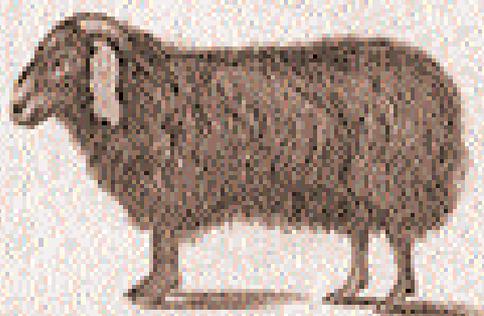
Broad tailed Sheep.



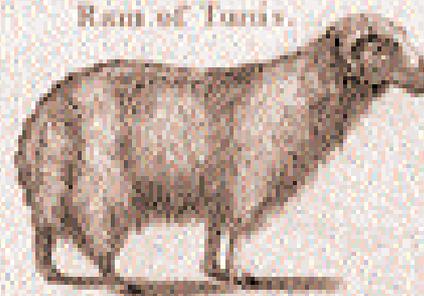
Indian Ram.



Cape Sheep.



Ram of Tunis.



The back cover illustrates Sarah Franklin's article on 'sheepwatching' in this issue (see p. 3). Sheep are not clearly typologized in this eighteenth-century engraving of sheep varieties, which range from generic categorisation by sex (common ram) to distinction by region (Barbary Wedder) or nation (Spanish Ram). Sheep-breeding was organized through such general categories until the 'modernization' of breeding was successfully pioneered by Robert Bakewell, who introduced the idea of the distinctive individual animal with 'ideal'

breeding qualities (previously individuals were not systematically selected in such a way). The 'breeder's hand' was in turn one of the main analogies used by Darwin to depict the evolution of new species out of previously 'bounded' ones. Sheep-breeding continues to be an important source of industrial innovation, through, for example, the series of unique animals produced at the Roslin Institute, including Dolly.