

# SEARCHING FOR THE ‘WIN-WIN’? ANIMALS, GENOMICS AND WELFARE

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## Introduction

As it tries to cast off prior attachments to a definition of the social purely in terms of the human there are signs that social science investigations of human/animal relationalities are on the increase<sup>1</sup>. In considering animal welfare in agriculture there are of course longer standing traditions of analysis into food, rurality and agricultural systems that offer ways into a focus upon animals themselves. For those who centre an analysis around issues of power and justice it is problematic to focus solely on welfare. A welfarist approach is a specific kind of ethical approach which operates within the confines of anthropocentric thought and accepts the utility of animals. In a compassionate and scientific approach toward albeit more *humane* human/animal relations it continues to proffer a ‘human’ that exists over and above other animals. Welfare in this understanding may be understood as a placation of our dissonance in our treatment toward other animals. Or indeed one may be a ‘new welfarist’ (see Francione 1996) whom, although in critique of the utilitarian ethics of animal welfare, supports an approach of incremental change toward a longer term ‘progress’ in our treatment of other animals. But to underline at the outset that a discussion of animal welfare speaks to a particular *frame* of human/animal relations does not disqualify it from sociological interest.

Diverse conceptions of animal welfare point to competing discourses of the animal and underlying values which posit the ‘good’ life for animals differently. Whilst those whose values fit better within non-utilitarian ethical frameworks (for example, virtue ethics or intrinsic value positions) may want to argue that a ‘good’ life for an animal would consist of their actual escape from a system of agricultural commodification we must note that even within welfarist viewpoints there are a diversity of positions. How these are expressed within science discourse is of interest as it may tell us something about the social context of animal science generally and more specifically about conflicting discourses and changes of emphasis. Fraser (2003: 435) introduces a useful description of three different conceptions of animal welfare at play within the broader field of animal welfare science, but also animal science generally. First, we see an emphasis on biological functioning and health as the main determinant of welfare. Second, we see a framework which emphasises the ‘affective states’ of animals and so is more focussed upon concerns of pain, suffering and the measurement of other internal states. Third, Fraser outlines a framework which conceptualises welfare as allowing the animal to live as closely as possible to ‘natural’ circumstances (*ibid.*). These are rather paradigmatic since they span a spectrum from neo-Cartesian views of animals to others which attempt to respect the sociality, subjectivity and environmental embeddedness of animals. Such

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<sup>1</sup> For example, the British Sociological Association recently created a study group centred upon human/animal relations.

frameworks, as Fraser acknowledges, are themselves culturally embedded and so one must bear in mind how they might translate or not in the geo-politics of global agricultural production<sup>2</sup>. In turn trends in welfare practice and animal science discourse speak to broader debates in agriculture around productivist and non-productivist values as well as piquing the sociological interest in the mobility of society/nature relations and conceptualisations. This paper adjoins this interest with a focus upon genetic selection and the emergence of new molecular technologies in animal breeding. It explores some of the impacts that selection and the uptake of genomics may have on understandings of welfare.

## Methods

As well as referring to existing research I draw upon semi-structured interview data obtained during 2006 when 22 UK based animal scientists were interviewed about ethical and social aspects of developments in farm animal genetics. These comprised welfare scientists as well as geneticists and thus offer insights on current salient issues and differing ideas of animal welfare. All these scientists either worked at or were involved in work at two leading research centres in Central Scotland, namely the Scottish Agricultural College and the nearby Roslin Institute. Approximately a quarter interviewed were welfare scientists, with the remainder mostly animal geneticists (two agricultural economists were also interviewed). Six were female and sixteen were male, with the majority established scientists as opposed to early career. Interviewees were accessed both by letter and e-mail. The current UK Research Council policy of encouraging collaboration between research councils undoubtedly helped access as this work is funded by the ESRC (Economic and Social Research Council) whilst the Roslin Institute is funded by the BBSRC (Biotechnology and Biological Sciences Research Council). These two research centres were chosen for several reasons. They are world leaders in their fields, they have consistently shown a willingness to engage with ethical and social issues, and they are both interdisciplinary animal science research centres. This entailed that they were ideal sites to probe a number of questions not least the potential impact of genetics and genomics on understandings of animal welfare. Data was analysed using Atlas.ti software – coded to identify various themes of interest. A broader picture of the animal science field was also obtained through attendance at animal science conferences as well as through literature review.

Furthermore this paper refers to the recent work of the UK Farm Animal Welfare Council (FAWC) on the ‘Welfare Implications of Animal Breeding Technologies in Commercial Agriculture’ (2004). We remain in the early days of molecular techniques. Genomics has seen, to date, only a limited commercialisation. Genetic modification (GM) and cloning remain under research and may see a limited commercialisation within 5-10 years<sup>3</sup>. Therefore before turning to molecular technologies (in the main genomics) I want to begin by assessing the relationship between non-molecular genetic selection (selective breeding) - which has itself led to

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<sup>2</sup> I thank one of my anonymous referees for underlining this point. It is highly salient to discussions of animal welfare but beyond the scope of this current paper.

<sup>3</sup> This is contextualised by global politics. Scientists I interviewed in the main did not see a short term future for these techniques due to both technical obstacles and public acceptability. However it’s worth noting that GM fish may be commercialised in North America in a few years time, and cloning research for agriculture is being actively pursued in North America and other parts of the world. Moreover one of the issues raised by the FAWC report relates to the *import* to the UK of GM or cloned embryos.

very significant increases in productivity across all farm animal species in the post-war period - and welfare

## **Genetic Selection, Unintended Consequences and Welfare**

On the one hand from a perspective trained upon the goals of agricultural output genetic selection has been incredibly successful in optimising animal bodies to produce more meat and milk. Indeed it has been too successful in that the economies of the West are witness to a situation where output exceeds requirements (see Bishop & Woolliams 2004: 913) and it is very probable that the low cost availability of animal products is a contributory factor to diseases common to affluent countries such as heart disease, obesity and various forms of cancer. Although this health burden certainly represents one unintended consequence of the Fordist and biopolitical appropriation of animal bodies, decisively enabled by their genetic interrogation, it is a different unintended consequence that I wish to focus upon here.

It has become clear that the productivity drive of selecting for particular genotypes has had the unintended consequence of producing negative welfare impacts upon agricultural animals. So much so that 'welfare' issues arising out of production also themselves become issues of profit compromising production. I shall return to the issue of conceptual confusion over 'welfare' and 'production' later on in the paper. The productivity drive goes hand in hand with other goals of reducing costs in related areas. Thus it is tied to also producing animals that can subsist on low feed intakes, as well as other non-genetic technical attempts to maximise efficiency such as the introduction of robotic milking systems to reduce labour costs (see Holloway 2007). That selection for high production efficiency has resulted in deleterious welfare impacts was reinforced within my interviews with both animal geneticists and animal welfare scientists. These two quotes came from animal geneticists:

*"They've gone hell for leather for high yielding dairy cows but in actual fact it's made them more susceptible to mastitis and because the management, you know, it can only go so far."*

*"It's clear that many of our current systems and practices have question marks over social acceptability, ethical issues and that includes the focus on a rather narrow set of production related characteristics in our breeding programmes which is now known to have caused some unfavourable side effects. So focus on the milk yield in dairy cattle for instance is known to have caused a reduction in fertility, probably an increase in mastitis, probably an increase in lameness."*

In the example here of dairy cattle the emphasis on production has been to such an extent that the unintended consequence has come to be an issue for the perpetuation of productivity itself. In a broad ranging review paper that presented over 100 references on undesirable correlated effects of selection for high production efficiency Rauw et. al. showed that such an approach seems to put animals at a greater risk of behavioural, physiological and immunological problems (1998). They suggest that animal breeding scientists in their focus upon the technical aspects of selection may have lost sight of some of the underlying biology of genetic selection. Thus they put forward the theory that if *"genetic changes are too radical or sought too rapidly, the population may lack the time required to adapt to the changes imposed on it by selection and the homeostatic balance of the animal is at risk"* and that molecular

techniques could exacerbate this problem (ibid., p. 27-9). This theory appears to hold true in the case of battery hens. The productivity of egg laying hens is increased through the genetic manipulation of body weight and the environmental manipulation of day length. Yet the egg laying pressures are such that a hen's body starts drawing upon reserves of calcium from its bones in order to make eggshell. Unsurprisingly this weakens the bird's skeletal structure contributing to welfare problems (see Duncan 2001: 210/11).

The Farm Animal Welfare Council (FAWC) has for a considerable time drawn attention to the negative welfare impacts of conventional selective breeding techniques (1997, 2004) arguing that health traits should take precedence over production traits in breeding programmes. Yet there is a sense that it is difficult to make the case for welfare when a particular problem may be treated and does not impact seriously upon profit. It is difficult for a welfare argument to have leverage if proposed changes would impact upon already established breeding programmes that are commercially successful (see FAWC 2004: 17). Nevertheless as I discuss further below there *has* been a tangible shift away from purely productivist values in the research pursued by animal genetics scientists.

The hope from animal geneticists is in fact that more genomic information will allow the possibility to avoid the negative side effects of selection although it is unlikely that molecular techniques will offer an escape from unintended consequences. This provides a good example of what Beck refers to as the 'boomerang effect' wherein "*sooner or later the risks also catch up with those who produce or profit from them*" (1992: 37). Thus the over-rationalisation of animal bodies comes unstuck and human attempts to push home the mastery of other species come up against a biological limit which potentially opens a space for critical reflection. But since solutions to the unintended consequences of genetic selection are generally posited in terms of more, yet different, genetic selection it is clear that the critical reflexivity does not extend *systematically* to a questioning of selection per se. This is evident in Duncan's paper on animal welfare issues in the poultry industry where he repeatedly argues that the solution will be found in genetics (2001). It might appear odd that the very same technical-rational genetics approach that has been implicated in the problem should be turned to to address it. On the one hand it may not seem reliable and, more sociologically, it may perpetuate a particularly genetic and arguably reductive view of the animal. Yet in the frame of animal breeding it is difficult to conceive of an alternative that could actually address the physiological problems which animals face. This issue arose in my interviews with animal scientists. Thus in a discussion of lameness with an animal welfare scientist the following exchange:

RT: "*What causes that in most cases?*"

Scientist: "*It's a production disease; it's an intrinsic part of modern dairy production*"

RT: "*And so even though that's a production disease, there are moves to try and address that through genetic selection?*"

Scientist: "*Yes there are, you can select bulls whose daughters should have a better locomotion score. Several issues there, one is we believe on our side of the fence, the welfare side, they don't really measure this very well. And even if they did what we wanted them to do there's an enormous amount of difficulty*"

*at this end and just in measuring our farms. Consequently the heritability is poor. So they can't make much progress with it anyway because the heritability is slow.*

RT: *But it's using the same method that's produced it to try and address it isn't it?*

Scientist: *You mean breeding?*

RT: *Yes*

Scientist: *Yes which is curious.*

RT: *Because if you tried to solve it through an environmental way it wouldn't be cost efficient?*

Scientist: *Well people, very good question I mean, yes it's not just that they've been bred to produce lots of milk, they're also kept indoors and the longer they're indoors, the bigger the risk they get lame. So they could be kept out more often, they could be fed at a lower rate and probably milked less often, that would probably reduce the risk. They could be in better quality cubicles. But that's investment. They could have their feet trimmed more often..*

RT: *It's labour cost?*

Scientist: *..But it costs, this is the thing it costs a lot, you know lame cows don't produce milk; they often have to be replaced. And that's one of the things that we've been trying to get across as you know if you actually add up the hidden cost.*

Even though it's a production disease it is multi-factorial and not wholly genetic, although there is a correlation between selection for productivity and lameness. In some cases then the economic context of agriculture may play a role in shaping which problem solving strategy may be adopted. Yet the question of whether selection is returned to in order to solve a welfare problem also came up when I pondered on its curiosity to a geneticist:

*"Well it's interesting actually because I could argue exactly the opposite. I could say if selection caused the problem then selection stands the biggest chance of being able to correct it. Yes? But that would be my argument. I can understand that people would say well selection caused the problem so therefore we're going to do something else to resolve the problem. But if the problem exists through selection unless you select against that problem it will remain there. Unless we genetically improve cows for mastitis they will remain at their current level of mastitis. So selection obviously has got to occur in order to be able to raise the mastitis level. The way I see it that the problem has actually been not through selection itself but through inadequate selection".*

This last sentence is particularly important I think as it reflects a view that is rather widespread in animal science that it is not a particularly approach or technology that is 'good' or 'bad' but how you apply it. This is a rather crucial point of contention vis-à-vis social views of science where techniques themselves are seen as socially, historically and politically embedded. But to accept this might be to allow an overly

critical stance that could undermine the rationale of conventional breeding itself. Therefore it is unsurprising that a position of technological neutrality is asserted. Nevertheless due to the historical trajectory of genetic selection and its associated material construction of the animal toward productivity there must in fact be some truth in the above quote arguing for a genetic response. Thus it would be quite incorrect to portray welfare scientists as against selection per se. On this point one welfare scientist said to me:

*“So it’s like you know I disapprove of the fact that we got there in the first place, but given that we are there and if these things are developed I think that’s the least we can do”*

Similarly welfare scientists were broadly strongly in favour of selecting animals that could cope with better welfare environments – a situation necessitated by the fact that due to a past history of selection for productivity some animals are in fact ill suited in terms of strength, mobility and health for better welfare environments. Although a non-utilitarian ethical framework may want to take the position that it is selection itself that is the problem animal welfare scientists operate within a context where pragmatism is to the fore and their wishes are constrained by the broader economic goals of commercial agriculture. But if animal welfare science is partly tasked with responding to public concerns about the experience of animals in agriculture then it seems that, given the legacy of unintended consequences, there needs to be further critical reflection upon selection itself. One important shift in selection goals that may be seen as a response to such societal concerns has been a new focus on health alongside productivity and it is this to which I now turn.

### **Welfare as Health and the Idea of the Win/Win**

Clearly it is in the interests of animal production to stem the effects of these unintended consequences not self-evidently for ethical reasons but because they also impact upon profitability. But if this can be combined with an approach that may be said to improve the background health of animals and potentially also improve their welfare then could it also be satisfactory to the concerns of welfare science and by implication to some sense of public concern? During the interview process a recurrent idea revealed by the data analysis was that of the win/win selection. This encapsulates a broader selection decision that is said to balance commercial pressures with concerns of animal welfare. In a way it might be seen as the perfect response to animal ambivalence, an attempt to satisfy both trends of instrumentalisation and partial subjectification in Western human/animal relations simultaneously. Within the interview data the idea was mentioned by both geneticists and animal welfare scientists. Here follow some extracts, each from a different scientist:

*“So in a way what we’re doing is a win-win situation. If we breed animals that are more resistant to disease the farmers spend less time and less money on preventative treatments but also the welfare of the animals is improved as well in that they are inherently more healthy than, you know, had we picked the wrong sire”.*

*“I think many farmers would believe that pushing for very high standards of welfare that perhaps people who are detached from animals aspire to, is going to cost a lot of money. But in fact a lot of our research on larger species at least shows that there*

*can be win-wins here. In dairy cattle for instance we've shown that by expanding selection away from just milk production alone, to include resistance to mastitis and lameness and to include fertility, it is expected to increase economic returns as well as reduce welfare problems".*

*"Obviously some diseases are of major economic importance, and if one could make animals that are basically fitter, healthier and more able to resist disease, then you're benefiting the animal, you're reducing the need to treat them with drugs and antibiotics so there's a potential downstream benefit for the human food chain. And so there's a sort of a potential for a win-win situation if you can do that effectively"*

*"There are quite a few examples where welfare and production values go hand in hand but they obviously don't totally mix or at least not in the eyes of society otherwise there wouldn't be people saying ban these cruel factory farms. I don't see production and welfare as being equivalent, but I don't see there being a problem with working on a project in which both production and welfare are improved. And it's certainly more likely to be taken up by industry if you can show that you have invented something that's going to improve both welfare and production and everybody wins"*

Within the emerging discourse of sustainable production there is considerable scope for so called win/win research projects with animal welfare scientists and geneticists working together. One example is a focus on the concept of 'robustness'. Thus a recent DEFRA (The UK government's Department for Environment, Food and Rural Affairs) funded project explores the idea of the robust dairy cow. Here a robust cow is defined as one that adapts well to a wide range of environmental conditions or in genetic terms expresses a reduced genotype x environment interaction when tested across different environments<sup>4</sup>. This overlaps with the previous example of the need to select for animals that can cope with improved welfare environments but 'robustness' is also about producing animals that are overall less sensitive to environmental variability. It is important to scrutinize the implicit understanding of animal welfare that may be at play within the win/win and related concepts such as 'robustness'. Although reflexivity to the short-termism of pursuing narrow production breeding goals may have opened up the opportunity for a broader, welfare inflected selection criteria it may be constraining the sort of welfare strategies adopted. While one might counter that it is not surprising that the boundary between production and welfare should become blurred for they are both utilitarian approaches, the indistinction of the terms within the idea of the win/win raises philosophical questions over the very ethos of animal welfare. If we highlight the words of the welfare scientist above – *"I don't see production and welfare as being equivalent, but I don't see there being a problem with working on a project in which both production and welfare are improved"* – the main ethos of welfare is perhaps one of pragmatism, doing what one can to improve welfare within the constraining context of commercial precedence. Furthermore the approach of adapting animals to

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<sup>4</sup> See [http://www2.defra.gov.uk/research/project\\_data/More.asp?I=LK0657&M=CFO&V=NMR](http://www2.defra.gov.uk/research/project_data/More.asp?I=LK0657&M=CFO&V=NMR) (Last Accessed April 2007).

particular environments may well open up novel ethical concerns. This was captured well in an extract with an animal welfare scientist –

*“Adapting animals to environments is not necessarily a bad thing, it just depends on how you do it and what the reasons are for why you do it....in the wrong hands it could be used for example to breed animals which are capable of coping with or indeed maybe thriving in what would currently be regarded as sub optimal conditions”*

In terms of narrow motives of commercial gain it is not difficult to see the possible attraction of a more docile and perhaps less sentient animal that could be kept in cheaper conditions. As the FAWC report argues *“whilst breeding for temperament has been carried out for hundreds of years, the protection of behavioural flexibility and sentience in animal breeding is becoming an issue where regulation may be necessary”* (2004: 26). The report also offers the example of research on genetically blind hens that were said to be both more productive and had reduced stress levels<sup>5</sup>. Could then such animals be considered to be the products of a win-win selection? Molecular techniques may offer more opportunities for these sort of applications that ethically, as the FAWC report argues, go beyond issues of pain, stress and suffering (see 2004: 25), instead asking questions of the human, of ‘how far we should go’? One might ask how the legal status of farm animals in the Treaty of Rome as ‘sentient beings’ as opposed to ‘agricultural products’ might inform this debate?<sup>6</sup> Perhaps the Protocol on Animal Welfare as part of the Treaty, which made history by referring to animals as ‘sentient beings’, could be used to legally argue against such selection decisions. However, given the gradual selection for docility that has taken place using non-molecular selective breeding one could anticipate that proponents would use ‘arguments from precedent’ (see Parens 1998, Twine, 2007b) to try and justify such selection even if the use of molecular techniques could be used to make such changes more direct, more biologically systematic and more rapid. In addition, as Camm & Bowles point out, the reference to animals as ‘sentient beings’ does not in fact *“exclude the treatment of animals as goods or agricultural products in other contexts”* (2000: 201). Whilst sentience is one concept that may be introduced to perform a protectionist role, a further one is that of telos<sup>7</sup>. Rollin has defined this as the *“set of needs and interests which are genetically based, and environmentally expressed, and which collectively constitute or define the ‘form of life’ or way of living exhibited by that animal, and whose fulfilment or thwarting matter to the animals”* (2003: 344/5). It is of course difficult to talk of a telos in animals that have been gradually but significantly selectively bred over a long period of time and to argue that such ‘thwarting’ has not *already* taken place. This is indeed the understanding behind ideas of corrective selection that seeks to ameliorate the negative welfare consequences of past selection. I will return to the question around these sorts of selection decisions in the next section.

<sup>5</sup> It is interesting to note that in a 2006 interview utilitarian philosopher and author of *Animal Liberation* Peter Singer advocated using biotechnology to produce ‘brainless’ or wingless birds. See Broudy (2006) at <http://www.salon.com/books/int/2006/05/08/singer> (Last accessed April 2007).

<sup>6</sup> Thank you to one of my anonymous referees for asking this very question.

<sup>7</sup> Although it should be underlined that Rollin argues against the position that *telos* should prohibit genetic engineering (ibid.). One could certainly take issue with Rollin’s argument, his definition of *telos*, and the essentialist problems of the concept generally, but that discussion is beyond the scope of this paper.

Conventional selection and the use of molecular techniques can be used to impact upon both the health *and* behaviour of animals. With increased knowledge of gene function and interaction more complicated traits that have been harder to measure may come into the field of manipulation. The concerns for welfare science are that welfare may come to be seen more and more in terms of measurable health, function and performance, and that aspects of welfare that pertain more to the subjective and social life of animals - aspects which may have more of a cost in terms of their provision – will be de-emphasised<sup>8</sup>. The concern here may be that the partial geneticisation of welfare is also an instrumentalisation of welfare where aspects such as health and robustness may be seen as bound up in productivism as much as they are in welfare. Additionally they could be seen as invested in an overly biologicistic account of farm animals, as was the concern of one animal welfare scientist interviewed:

*“On the other hand there’s also a trend, a parallel trend where it’s almost like we’re going backwards in time and welfare is becoming more and more an issue just of health, you know physical health. And that is partly what we’re talking about, you know it’s like metabolic stress because they’re in the first place conceptualising animals as complex production systems and then they’re talking about the health of that system. I see it as my own task and other colleagues to counterbalance and to develop concepts that are close to the subjectivity of the animal. And to also, I mean how could you possibly talk about boredom and depression you know in a complex metabolic system? It’s not going to happen is it?”*

There is of course an historical legacy of seeing animals as more biological vis-à-vis the human (e.g. see Birke 1994). It is just this legacy that many animal welfare scientists are trying to erode by stressing the subjective and social life of farm animals. But for some animal scientists the use in the above extract of terms such as boredom and depression represents an error of anthropomorphism. In the tensions that do take place between welfare science and animal genetics the charge of anthropomorphism is certainly deployed as a means to both reinforce human/animal dualism and to portray animal welfare as somehow less than scientific. It is more accurate to present the two fields (each diverse as they are) as in opposition over underlying assumptions of the animal and human/animal relations. Without wanting to dismiss the problems of anthropomorphism the concept does operate to perform ‘boundary work’ (Gieryn 1983) between different claims over ‘real’ science within the broader animal science field. Classically then with its accoutrements of control, ‘objective’ measurement, statistics and dispassion, but most decisively in its service to applied commercial goals, genetics has been hegemonic. Attending animal science conferences as part of my research it became apparent that welfare remains in a marginal position, and welfare scientists reported that they were more likely to attend ‘their own’ conferences. The debate over whether we can use terms such as boredom and depression is less important than recognising a subjective and social life for animals and allowing also for the a psychological as well as physical impact of close

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<sup>8</sup> For a critique of the position which argues that animal welfare research must focus on the functioning of animals because subjective experiences fall outside the realm of scientific enquiry, or that studying the functioning of animals is sufficient because subjective experiences and functioning are closely correlated, see Fraser et.al. (1997).

confinement and so on. The point here is that there may be a significant difference in the sort of welfare and accompanied notions of what constitutes a ‘good’ life for animals in agriculture allowed for in the language of the win/win and selection generally compared to that found in research that takes animal subjectivity and sociality seriously. Since molecular approaches such as genomics are not typically about seeing the whole animal but about probing causal relations between genotype and function within a commercially orientated rationale it is likely that the sort of welfare framework employed (if at all) will be more akin to that expressed in the quotation above. This corresponds to the first framework discussed by Fraser (2003) at the outset of this paper as welfare in terms of biological functioning. If this is correct then molecular approaches could represent a consolidation of neo-Cartesian understandings of farm animals; and discursive jousting with some areas of animal welfare science as the site of their contestation<sup>9</sup>. In the final section of this paper I examine more closely the possible relationship that could emerge between genomics and welfare.

### **Genomics and Animal Welfare**

If we were to take the position of neutrality assessing the impact of genomics upon animal welfare this would be an exercise in determining how social and economic contexts were likely to drive the application of emergent molecular technologies in farm animal breeding. However a sociological approach argues for the sociality of scientific practice and stresses that both science and technologies are redolent in meaning, values and goals. The naturalisation of a broadly utilitarian outlook toward nonhuman animals is the case in point in animal sciences. Genome sequencing work on agricultural animals takes place within the context of making economic efficiency gains in farm animal production. Here the production of genomic knowledge is bound up in the biopolitical revelation of the animal body to tease out new value and new strategies for commodification (see Twine 2007a). Unlike genetic modification genomics works within pre-existing variation, for example, finding disease resistant genotypes in the current pool. Its techniques such as gene assisted selection and marker assisted selection may be used to alter a population’s gene pool through the direct identification of economically valuable genotypes. Whilst the production of GM or cloned animals raises important ethical and welfare questions (see Holland & Johnson 1998, Van Reenen et. al. 2001, FAWC 1998) the focus here is on genomics. Genomics is sometimes constructed as the less radical of molecular techniques in the face of public concern over GM. Nevertheless genomics, although still not in widespread commercial use, offers more precision and control in genetic selection. Conventional selection which has operated without the knowledge of specific underlying genes is often parodied as a ‘black box’ approach, whereas genomics is championed as opening this box, as providing enlightenment, through the possibility of gene identification, and direct selection.

In spite of this there was a feeling amongst scientists interviewed that genomics was certainly yet to live up to expectations and had been subjected to a fair amount of hype as these extracts illustrate:

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<sup>9</sup> Relatedly, there is now increasing pressure upon scientists to produce an objective measure that provides stakeholders (e.g. consumers) with an overall score for welfare. This may serve to privilege those very ‘objective’ quantifiable measures that do not typically perform the best job at understanding the subjective, qualitative aspects of animal welfare. I thank one of the anonymous reviewers for this point.

*“quite often results from genomics and genetics are sensationalised and built up and the expectations from genomics and genetics are so high or have been certainly in the farm animal industry, whereas in reality to date it hasn't actually reaped nearly the benefits that one might expect given the amount of investment that has been put into it”*

*“there have been massive advances in molecular genetics, there have been huge contributions to knowledge, but I would argue that contributions to genetic improvement of animals and probably to a lesser extent plants, have not lived up to those earlier promises”*

*“many of my colleagues here we're slightly cynical about the great sort of splurge of interest in genomics and the apparent potential of it. And in fact it's not delivered very much at all. Whereas the whole issue of just how effective marker assisted selection can actually be as opposed to the more old fashioned quantitative genetic approach which certainly works, this is just an ideological thing. I guess I side with my quantitative genetic colleagues here who are probably seen as being in the old camp but that's because they work with real life animals breeders you know and they actually are out there making a difference. Whereas the other people I think are much more lab based, kind of more theoretical really”*

Although there was a certain loyalty to quantitative genetics expressed there was also enthusiasm in molecular techniques and the new knowledge generated. The approaches are not mutually exclusive and are beginning to be used side by side. Although genomics is yet to find a widespread commercialisation the speed at which molecular knowledge can be sequenced has increased whilst the cost of the process has decreased. This has co-evolved with the IT infrastructure necessary for the creation and analysis of large scale animal genomics databases. Advocates of genomics in the wider literature see the technology as increasing the accuracy of estimated breeding values, the rate of 'genetic improvement' (Plastow 2006: 3) and providing the ability to target traits, such as disease resistance and meat quality, that are difficult to measure with traditional selection (DeNise 2004: 4, Bishop & Woolliams 2004: 913). Moreover phenotype measurement of some traits is expensive and so marker technology is seen as a possible solution (Dekkers 2004, Plastow 2006). Genomics is also seen as providing an important contribution to sustainable livestock production systems (Bishop & Woolliams 2004).

The emergence of sustainability as a key principal in agriculture and animal science funding has meant that genomics has become partly orientated to this agenda. It is worth bearing in mind the now familiar slipperiness of 'sustainability' in that it can at times be used to refer to a narrow notion of *economic* sustainability. However, an interesting consequence of the emergence of sustainability which reflects a partial erosion of productivism is that breeding goals now may include 'socially and environmentally important traits' alongside the traditional focus on selection for economic output (e.g. Kanis et. al. 2005). There has been something of a shift from within animal science that indicates the awareness of a relationship between economic short termism; unwanted side effects and therefore unsustainability (see Olesen et. al.

2000: 570). It is as yet unclear as to the extent to which such awareness inflects genomics. If one scrutinises lists of currently identified genetic markers and commercialised DNA tests for these markers one sees a diversity of foci (see e.g. Dekkers 2004: 317, Rothschild 2004: 12, Hocquette et. al. 2007: 164). Although we observe markers for growth, yield and reproduction which suggest a continued interest in output, we also observe markers related to more qualitative concerns such as meat quality (e.g. tenderness, fat content), congenital defects and disease resistance or susceptibility. In spite of the diversity they all relate to either decreasing costs or enhancing performance. It is important to appreciate the applied nature of animal science. That is to say it is considerably more tied to the economic sphere than most other science fields. Economic modelling plays an important role in the selection of traits and the shaping of research, and market goals act to constrain or enable the application of research. The actual impact of a discourse on sustainability (and the question of which discourse) on the developing trajectories of genomics remains to be seen.

Whilst some of the qualitative emphases to be found within markers and tests made possible by genomics research can be said to pertain to welfare and are discussed in such terms (Plastow 2006) they speak to the fuzzy indistinction between production and welfare discussed earlier. When the cost of disease to animal agriculture is put at £1.7 billion in the UK alone<sup>10</sup> it is not surprising that this is identified as one important area where efficiency gains could be made. That genomics is seen as offering an advantage over conventional breeding in this area is significant to both its funding and general support. Other markers aim to be economically useful either through a further optimisation of productivity or by adding value qualitatively to be attractive to niche markets that express consumer preference for a particular taste or for more healthy animal products. However in terms of animal welfare genomics would seem to conform to a narrow emphasis on welfare as health and performance that can be spoken about in terms of a win-win but may exclude other definitions of welfare.

Although, as highlighted earlier, there is little need to boost production in Western Europe the global nature of farm animal breeding is very relevant to thinking about the potential impact of genomics and other molecular techniques on welfare. Future scoping documents on animal science and agricultural policy speak of a 'livestock revolution' which refers to an expected global increase in consumption of animal products of around 7% per year for the next 20 years largely in response to rising population levels in developing countries such as China and India (FABRE-TP 2005: 4). Whilst the assumption that such an increase is wholly demand driven or in the interests of human health should be deconstructed the point here for thinking about welfare is that productivism could be reinvented through the global elaboration of agricultural policy and politics. Furthermore molecular technologies are being cast as important techniques in this neo-productivism. These techniques which put forward an idea of life as mobile, exchangeable informational code and as amenable to standardisation also then fit well with goals surrounding the globalisation of markets (see Thacker 2005). Although it is commonly argued that Europe has high welfare standards (clearly a relative claim), such standards are not the same in other parts of the world. The sort of research into 'robust' animals discussed earlier is also seen as attractive in terms of global standardisation due to the aim of producing

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<sup>10</sup> This figure is from Bishop & Woolliams (2004: 914).

animals able to cope in a wide range of diverse environments. Indeed one might envisage a selected 'robustness' being an animal's main source of welfare with the concern being that animals will be selected to cope better with poor welfare conditions touched upon earlier.

This is a point of concern which has been made in relation to research into both 'robustness' and disease resistance. In a discussion around 'robustness' research one welfare scientist expressed that:

*"There is a lot of interest in immuno-tolerance in animals. If people could crack the immune system of pigs for example so that they didn't get sick when you crowd them into buildings..."*

A similar point was made in the FAWC report (2004) in relation to the development of genomics, specifically around markers for disease resistance. The report expressed the view that once commercialised production traits could take precedence.

*FAWC recognises that the application of gene-mapping to selective breeding programmes may be used to rectify recognised welfare problems, for example, by selecting for specific health traits such as improved leg health in broilers. We are concerned, however, that with the considerable commercial competition between breed companies, the primary focus of attention will be for production-related traits (2004: 18).*

It is naïve then to assume that commercialisation will necessarily either foreground sustainability or a notion of sustainability that includes welfare. On the disease resistance variety of genomics research the FAWC report said:

*Whilst this will have obvious welfare benefits, it is important that the development of such strains is not used to disguise welfare threatening conditions which would otherwise produce disease and does not discourage the development of higher standards of stockmanship and provision of a good quality environment (ibid. p.19).*

This expresses a concern over welfare geneticisation and the tension between a health model of welfare and one that foregrounds attention to conditions, to animal experience. If here we can see potential risks over the commercialisation of animal genomics, like conventional selection we can also point to some potential risks around the biology<sup>11</sup>. One example of genomics commercialisation in the UK is the National Scrapie Eradication Plan which uses gene assisted selection to select for a haplotype that has been associated with scrapie resistance. Villanueva & Roughsedge point out three potential risks with the eradication plan (2006). First, a new transmissible spongiform encephalopathy (TSE) could arise which the currently favoured haplotype may not confer resistance to, second, the eradication programme may lead to lost attributes (i.e. 'bad' genes can be 'good' genes and vice versa) and, third, selecting exclusively on one line creates the potential for lost genetic diversity. Villanueva & Roughsedge conclude that the plan "*did not initially consider the wider quantitative genetic implication of its aim. That is the association of non-disease traits with the various targeted genotypes and the effect that the plan would have on the*

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<sup>11</sup> I do not mean to imply biological risks as somehow isolated from either the sociality of science or the social and ecological embeddedness of animal bodies.

*management of genetic variation within the sheep populations*” (2006: 12). A process of sperm banking of rejected strains is advocated as an insurance against loss of genetic diversity. It would seem that genomics is as potentially subject to the unintended consequences that have been characteristic of the history of conventional breeding using non-molecular genetics.

This example, although the risks could turn out to be partly addressable through sperm banking, points to the possible dangers of adopting a narrow approach. If in this example we can note a concern of reductionism *within* genetic approaches it is also this point which structures concerns of animal welfare scientists over genomics. The interviews illustrated that for some animal welfare scientists there were philosophical disagreements with the shift to molecular genetics:

*“Primarily my stance is that that whole paradigm is heavily reductionist. It is based on the purity reductionist approach to animals and my problem with that is, you know it’s not wrong but it’s a huge imbalance. And a claim of the objective science paradigm that that’s the only objective paradigm....An animal isn’t just a complex system it’s a being, a living being, a subject. And so where is the understanding of that animal? And you know another ethical term is integrity right, intrinsic value, which I think is very important. And so where is the knowledge to balance reductionist and where is, it’s nowhere to be seen”*

Indeed this extract goes beyond the utilitarian ethics of welfare and begins to explore a richer ethical agenda inclusive of deontological ethics. If we accept that molecular approaches may be fostering a far more abstract and desocialised view of the animal (e.g. see Holloway 2005) we can note here a real difference in animal epistemologies at play. This is emphasised further if we look at the research methods employed by one of the animal welfare scientists interviewed. This foregrounds the interpretations of people working directly with animals in the form of asking for their descriptors of the animals’ welfare:

*“I ask people to develop their own qualitative descriptors. So I don’t put it in their mouth, it’s really they have to observe the animals and come up with their whole animal descriptors. So terms like aimless, purposeless, bored, depressed, those descriptors came up in the intensive systems and the other systems, the enriched systems it was like playful, content, lively, purposeful, busy you know”*

For this scientist the research was not only about constructing an alternative animal epistemology but also about valuing the knowledge of human/animal relations that farm workers possess:

*“You can see that typically with knowledge transfer from scientists it is always from high up down and treating the people who work with the animals as if they don’t have knowledge”*

This contrasts significantly with the molecular shift which eschews the ocular phenotypic knowledge of breeders as inferior to the interior gaze of molecular scientists (see Holloway 2005). The molecular turn puts its faith in the technological gaze and farm workers are conceived less as potential sources of knowledge more as potential obstacles to the application of genomics.

## Conclusion

Although we should stress the diversity of positions within animal welfare science we can see, at least for some, rather stark epistemological, philosophical and political differences over the ‘animal’ vis-à-vis those implicit within genetics and genomics. These contestations of the animal are on the one hand a tension point in the ongoing dynamic of society-nature relations and conceptualisations; and on the other a prerequisite for thinking about both the possibilities and limitations of welfare in agricultural production. The concerns of this paper have been that these possibilities are potentially being narrowed and the limitations being exposed by an intensification of the ‘animal’ as abstract genetic code within a global neo-productivism.

The development of farm animal genomics and potentially other molecular techniques are a part of what Lang & Heasman have termed the ‘life sciences integrated paradigm’:

*which relies on a simple re-interpretation of the existing productionist paradigm but claims to remedy a number of its limitations: from lessening environmental impacts, through improving human health from greater food production, to creating new products with enhanced, yet often contested, health benefits (2004: 22).*

The discourses of genetics and genomics within these broader shifts of agri-food restructuring make claims on their positive effect upon animal welfare in the form of ideas such as the win-win. But if, as this paper argues, we can note both the narrowing of animal ethics to welfare *and* the subsequent narrowing of welfare to health within the politics of animal science then there are reasons to doubt that such restructuring will be amenable to an ethics or a welfare that can explore new animal epistemologies or new human/animal relationalities that are more respectful to nonhuman life.

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## References

- Armstrong, S.J. & Botzler, R.G. (2003) *The Animal Ethics Reader* London: Routledge.
- Beck, U. (1992) *Risk Society – Toward a New Modernity* London: Sage.
- Bishop, S. & Woolliams, J. (2004) “Genetic approaches and technologies for improving the sustainability of livestock production” *Journal of the Science of Food and Agriculture* Vol.84, pp.911-919.
- Birke, L. (1994) *Feminism, Animals and Science – The Naming of the Shrew* Buckingham: Open University Press.
- Broudy, O. (2006) ‘The Practical Ethicist – An Interview with Peter Singer’ available at <http://www.salon.com/books/int/2006/05/08/singer/>
- Camm, T & Bowles, D. (2000) ‘Animal Welfare and the Treaty of Rome – A Legal Analysis of the Protocol of Animal Welfare and Welfare Standards in the European Union’ *Journal of Environmental Law* Vol.12, No.1, pp.197-205.
- DEFRA (2007) ‘Identifying and characterising robust dairy cows (LK0657)’ Project web-site: [http://www2.defra.gov.uk/research/project\\_data/More.asp?I=LK0657&M=CFO&V=NMR](http://www2.defra.gov.uk/research/project_data/More.asp?I=LK0657&M=CFO&V=NMR)
- Dekkers, J.C.M. (2004) ‘Commercial Application of Marker- and Gene-assisted Selection in Livestock: Strategies and Lessons’ *Journal of Animal Science* Vol.82 (E.Suppl.), E313-E328.
- DeNise, S. (2004) ‘*Genomics Overview*’ in *Creating Value From Genomics in the Pork Industry – A Roundtable Discussion* Monsanto Choice Genetics.
- Duncan, I. (2001) ‘Animal Welfare Issues in the Poultry Industry: Is There a Lesson to be Learned?’ *Journal of Applied Animal Welfare Science* Vol.4, No.3, pp.207-221.
- FABRE-TP (2005) *Sustainable Farm Animal Breeding and Reproduction – A Vision for 2025* Brussels: FABRE Technology Platform.
- FAWC (2004) ‘*Report on the welfare implications of animal breeding and breeding technologies in commercial agriculture*’ London: Farm Animal Welfare Council.
- FAWC (1998) ‘*Report on the implications of cloning on the welfare of livestock*’ London: Farm Animal Welfare Council.
- FAWC (1997) ‘*Report on the welfare of dairy cattle*’ London: Farm Animal Welfare Council.
- Francione, G. (1996) *Rain Without Thunder – The Ideology of the Animal Rights Movement* Philadelphia, Pa.: Temple University Press.

- Fraser, D. (2003) "Assessing Animal Welfare at the Farm and Group Level: The Interplay of Science and Values" *Animal Welfare* Vol.12, pp.433-443.
- Fraser, D., Weary, D.M., Pajor, E.A. & Milligan, B.N. (1997) 'A Scientific Conception of Animal Welfare that Reflects Ethical Concerns' *Animal Welfare* Vol. 6, No. 3, pp. 187-205.
- Gieryn, T. (1983) 'Boundary Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Science' *American Sociological Review* Vol.48, pp781-795.
- Hocquette, J.-F., Lehnert, S., Barendse, W., Cassar-Malek, I. & Picard, B (2007) 'Recent Advances in Cattle Functional Genomics and their Application to Beef Quality' *Animal* Vol.1, pp.159-173.
- Holland, A. & Johnson, A. eds. (1998) *Animal Biotechnology and Ethics* London: Chapman & Hall.
- Holloway, L. (2007) "Subjecting cows to robots: farming technologies and the making of animal subjects" forthcoming in *Environment and Planning D: Society and Space*.
- Holloway, L. (2005) "Aesthetics, genetics, and evaluating animal bodies: locating and displacing cattle on show and in figures" *Environment and Planning D: Society and Space* Vol.23, pp.883-902.
- Kanis, E., De Greef, K.H., Hiemstra, A. & van Arendonk, J.A.M. (2005) "Breeding for societally important traits in pigs" *Journal of Animal Science* Vol. 83, pp.948-957.
- Lang, T. & Heasman, M. (2004) *Food Wars – The Global Battle for Mouths, Minds and Markets* London: Earthscan.
- Michael, M. (2001) "Technoscientific bespokeing: animals, publics and the new genetics" *New Genetics and Society* Vol.20, No.3, pp.205-224.
- Olesen, I., Groen, A.F. & Gjerde, B. (2000) "Definition of animal breeding goals for sustainable production systems" *Journal of Animal Science* Vol.78, pp.570-582.
- Parens, E. ed. (1998) *Enhancing Human Traits – Ethical and Social Implications* Washington DC: Georgetown University Press.
- Plastow, G. (2006) 'The Use of Genomics in Animal Breeding' paper presented at the *Animal Genomes in Science, Social Science and Culture Workshop*, organised by the ESRC Genomics Policy and Research Forum, Edinburgh, Scotland, 5-7th April.
- Rauw, W.M., Kanis, E., Noordhuizen-Stassen, E.N. & Grommers, F.J. (1998) "Undesirable side effects of selection for high production efficiency in farm animals: a review" *Livestock Production Science* Vol. 56, pp.15-33.

- Rollin, B.E. (2003) 'On Telos and Genetic Engineering' in Armstrong, S.J. & Botzler, R.G. *The Animal Ethics Reader* London: Routledge.
- Rothschild, M. (2004) 'Value of the Swine Sequencing Project: New Discoveries and Uses' in *Creating Value From Genomics in the Pork Industry – A Roundtable Discussion* Monsanto Choice Genetics.
- Thacker, E. (2005) *The Global Genome – Biotechnology, Politics and Culture* London: The MIT Press.
- Twine, R. (2007a) 'Toward a Sociological Understanding of the Biotechnological Refashioning of Animal Bodies' *Genomics, Society and Policy* Vol.3, No.2, pp.99-117
- Twine, R. (2007b) 'Thinking Across Species - A Critical Bioethics Approach to Enhancement' forthcoming in *Theoretical Medicine and Bioethics*
- Van Reenen, C.G., Meuwissen, T. H., Hopster, H., Oldenbroek, K., Kruip, T.H. & Blokhuis, H.J. (2001) 'Transgenesis May Affect Farm Animal Welfare: A Case For Systematic Risk Assessment' *Journal of Animal Science* Vol. 79, No. 7, pp. 1763-1779.
- Villanueva, B & Roughsedge, T. (2006) 'Application of Molecular Genetic Information in Selection and Conservation Programmes of Farmed Animals' paper presented at the *Animal Genomes in Science, Social Science and Culture Workshop*, organised by the ESRC Genomics Policy and Research Forum, Edinburgh, Scotland, 5-7th April.