Biopower, heterogeneous biosocial collectivities and domestic livestock breeding

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Introduction

This chapter explores Foucault's concept of biopower[1] and its focus on the regulation and fostering of life. It examines the analytical potential of Foucault's anthropocentric conceptualisation in examples involving nonhuman animals. Specifically, it explores the empirical case study of livestock breeding in the UK, focusing on the increasing use of 'genetic' knowledge-practices in this context. It is argued that genetic techniques represent new ways of regulating life, and are associated with the emergence of a particular mode of biopower in livestock breeding which can be seen as part of a wider social process of 'geneticisation'[2].The chapter concentrates on the idea of 'population', a central element of Foucault's discussions of biopower, but develops a more heterogeneous sense of the term via an engagement with the notion of 'biosocial collectivity'[3]. As such, the chapter attends to the conceptualisation of nonhuman actors within the set of analytical tools provided by Foucault's biopower. First, after outlining the notion of biopower, it is argued that, from the basis of its focus on life, nonhuman animals can be understood in terms of relations of biopower, drawing on conceptions of population and biosocial collectivity. Second, the chapter examines empirically how new genetic knowledge-practices might be reconstituting the populations and biosocial collectivities associated with livestock breeding. Third, it is suggested that the emergence of genetic knowledge-practices might signal a new inflection of biopower, tied to new senses of population and biosocial collectivity.

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[1] Michel Foucault, *The History of Sexuality, Volume 1: An Introduction* (Harmondsworth: Penguin, 1990); *Society must be defended* (London: Penguin, 2003); *Security, territory, population. Lectures at the Collège de France 1977-1978* (Basingstoke: Palgrave Macmillan, 2007).

[2] Donna Haraway, *Modest witness@second millennium.femaleman meets oncomouse. Feminism and technoscience* (London: Routledge, 1997); Evelyn Fox Keller, *The Century of the Gene*. (Cambridge: Massachusetts, Harvard University Press, 2000); Nikolas Rose, "The politics of life itself," *Theory, Culture and Society* 18 (2001): 1-30.

[3] Paul Rabinow and Nikolas Rose, Biopower today. *Biosocieties* 1 (2006): 195-217.

Before going further, we briefly describe the shifts in livestock breeding practices that are referred to during the rest of the chapter and seen as a radical transformation by some commentators[4]. Livestock breeding has traditionally relied on a set of knowledges about animals which are in part tacit, in part informed by formal statements concerning what particular groups of animal should look like (e.g. 'breed standards'), and in part formalised records relating to specific animals (e.g. pedigree certificates). Breeding is strongly associated with the notion of 'breed', a concept emerging from the late 18th Century and more recently, in the late 19th Century. It is a process that has been institutionalised into breed societies, organisations which champion, catalogue and promote their particular breed[5].

More recently, breeding technologies drawing on genetic knowledge-practices have emerged and are becoming increasingly important in how some breeders understand and manage their animals. Two technologies in particular have become important interventions[6]. First, Estimated Breeding Values (EBVs), often referred to as the 'genetic value' of an animal, are based on the principles of classical genetics and have been used by some for several decades. They are statistical calculations, based on records from individual animals and their relatives, of the probability that an individual will pass on specific heritable qualities to their offspring. The second technique, genetic markers, is at an experimental stage as far as most breeders and breed societies are concerned. Markers, identified from animals' blood or hair samples, are actual genetic material associated with a heritable quality, such as meat tenderness. Marker tests are commercially available, with the companies providing them arguing that they will enhance decision making regarding livestock breeding and management.

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[4] Alan Archibald and Chris Haley, What can the genetics revolution offer the meat industry? *Outlook on Agriculture* 32 (2003): 219-226; Stephen Bishop and John Woolliams, 2004 Genetic approaches and technologies for improving the sustainability of livestock production. *Journal of the Science of Food and Agriculture* 84 (2004): 911-919.

[5] Margaret Derry, *Bred for Perfection: Shorthorn Cattle, Collies and Arabian Horses Since 1800*. (Baltimore: Johns Hopkins University Press, 2003); Harriet Ritvo, *The Animal Estate: The English and Other Creatures in the Victorian Age*. (Cambridge Massachusetts: Harvard University Press, 1987).

[6] See Lewis Holloway, "Aesthetics, genetics and evaluating animal bodies: locating and displacing cattle on show and in figures," *Environment and Planning D: Society and Space* 23 (2005): 883-902; Lewis Holloway and Carol Morris, "Exploring biopower in the regulation of farm animal bodies: genetic policy interventions in UK livestock," *Genomics, Society and Policy* 3 (2007): 82-98; Lewis Holloway and Carol Morris, "Boosted bodies: genetic techniques, domestic livestock bodies and complex representations of life," *Geoforum* 39 (2008): 1709-1720; Lewis Holloway, Carol Morris, Ben Gilna and David Gibbs, Biopower, genetics and livestock breeding: (re) constituting animal populations and heterogeneous biosocial collectivities," *Transactions, Institute of British Geographers* 34 (2009): 394-407; Carol Morris and Lewis Holloway, "Genetic technologies and the transformation of the geographies of UK livestock agriculture," *Progress in Human Geography* 33 (2009) 313-333.

In the next section Foucault's conceptualisation of biopower is outlined in a little more detail, before an argument is developed for a more heterogeneous sense of biopower which draws on the notion of biosocial collectivity.

Biopower, populations and biosociality

Foucault developed his thoughts on biopower in the first volume of his *History of Sexuality* (1990) and in parts of two lecture courses delivered in 1976-77 and 1977-78 (published in English as *Society Must be Defended* (2003) and *Security, Territory and Population* (2007)). For Foucault, biopower relates to systems of knowledge and strategies for intervention which are focused on the vital characteristics of human bodies. Biopower is centred "on the body as a machine: its disciplining, the optimisation of its capabilities, the extortion of its forces, the parallel increase of its usefulness and docility, its integration into systems of efficient and economic controls ..."[7]. Biopower is divisible into two related elements, an 'anatamopolitics', which focuses on the individual human being, and a 'biopolitics', which operates at the level of a population. Foucault placed the emergence of biopower in a particular historical and geographical context, that of Western Europe in the late 18th Century. This period demanded a strategy for managing newly concentrated populations during a period of industrial and agricultural revolution and urbanisation[8], associated with new forms of uncertainty requiring new ways to foster and regulate circulations of people and goods. As Rose suggests, biopower comes out of struggle to understand and intervene in the lives of subjects, "a multitude of attempts to manage their life, to turn their individual and collective lives into information and knowledge, and to intervene on them"[9]. At this time, then, new human sciences (e.g. demography) and new administrative institutions associated with the establishment of the nation state, combined and produced biopower as a mode of power-knowledge which "analyses, regulates, controls, explains and defines the human subject, its body and behaviour"[10]. In this mode, new phenomena, such as birth, death and morbidity rates, are given definition, and become important as targets for intervention.

Rose points to the importance of population in conceptualising biopower, arguing that biopower represents the "management of life in the name of the well-being of the population as a vital order and of each of its living subjects"[11]. Consequently, defining population as the group to be intervened on, is very significant[12]. Foucault's account of the emergence of biopower argues that it is associated with changing understandings of population. During the

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[7] Foucault, *History of Sexuality*, 139.

[8] Foucault, *Security, Territory, Population*; Stephen Legg, "Foucault's population geographies: classifications, biopolitics and governmental spaces," *Population, Space and Place* 11 (2005): 137-156.

[9] Nikolas Rose, *The Politics of Life Itself: Biomedicine, Power and Subjectivity in the Twenty-First Century* (Oxford: Princeton University Press, 2007), 53.

[10] Geoff Danaher, Tony Schirato and Jenn Webb, *Understanding Foucault* (London: Sage, 2000), ix.

[11] Rose, *The Politics of Life Itself*, 52.

[12] Hubert Dreyfus and Paul Rabinow, *Michel Foucault: Beyond Structuration and Hermeneutics* (Brighton: Harvester Press, 1982).

latter part of the 18th Century, and into the 19th Century, population became "considered as a set of processes to be managed at the level and on the basis of what is natural in these processes"[13]. This emergent way of conceptualising population is important. For, instead of assemblages of individuals who can be, through force and disciplinary relations, required to perform in particular ways, populations as *natural processes* are uncertain, unpredictable and difficult to direct and regulate. As such, "if one says to a population "do this", there is not only no guarantee that it will do it, but there is quite simply no guarantee that it can do it"[14]. Population regarded as a set of natural processes pertaining to collections of bodies thus requires quite specific modes of knowledge and intervention, so that "the naturalness identified in the fact of populations is constantly accessible to agents and techniques of transformation ..."[15]. This accessibility is one produced by, in particular, quantified and statistical means of measuring, representing and knowing populations, processes of statistical normalisation which act to formalise what behaviours and other characteristics are, and are not, acceptable, and disciplinary and other modes of intervention which act to transform bodies and populations.

Significantly, in terms of the development of the understanding of biopower, Rabinow and Rose turn away from the geographically-bounded sense of population which characterises Foucault's discussion. For Foucault, it was the populations of nation states, in particular, that were intervened on through the mechanisms of biopower. Rabinow and Rose, conversely, see the association between people and space as only one way of conceptualising populations. They write that biopower relates to "strategies for intervention upon collective existence in the name of life and health, initially addressed to populations that *may or may not be territorialized* upon the nation, society or pre-given communities, but may also be specified in terms of emergent biosocial collectivities, sometimes specified in terms of categories of race, ethnicity, gender or religion, as in the emerging forms of genetic and biological citizenship"[16]. Two points arise from this. First, as already mentioned, populations do not have to be, although they *may* be, territorialized. Second, other emergent phenomena, notably 'biosocial collectivities', can also be defined and related to population. Biosocial collectivity, for Rabinow, refers to the shaping of identities and forms of group activism by the emerging 'truths' of genetic science[17]. Biosocial collectivities can therefore be interpreted as intentional groupings in which what is at stake in a set of social relationships is a fundamentally biological issue. That is, it is to do with a problem of life itself[18], and is increasingly expressed around "new sites of knowledge (genetic, molecular biology,

[13] Foucault, *Security, Territory, Population*, 70.
[14] Foucault, *Security, Territory, Population*, 71.
[15] Foucault, *Security, Territory, Population*, 71.
[16] Rabinow and Rose, "Biopower today," 197, emphasis added

[17] Paul Rabinow, "Artificiality and enlightenment: from sociobiology to biosociality," in *The Science Studies Reader*, ed. Mario Biagioli (London: Routledge, 1999) 407-416; Sahra Gibbon and Carlos Novas 2008 "Introduction: biosocialities, genetics and the social sciences," in *Biosocialities, Genetics and the Social Sciences*, ed. Sahra Gibbon and Carlos Novas C (London: Routledge, 2008), 1-18

[18] Sarah Franklin, "Life itself: global nature and the genetic imaginary," in *Global Nature, Global Culture*, ed. Sarah Franklin et al. (London: Sage, 2000), 188-227

genomics) and power (industrial, academic, medical)"[19]. This sense of the biosocial collectivity as an active formation contrasts with the notion of population as a rather more passive term. Population comes into existence as a result of power-knowledge relationships functioning external to it and giving it definition, and is something which is intervened in, although that does not mean that its processes are fully understood or under control.

Foucault's and Rabinow and Rose's writing on biopower is characterised by an assumption that the target of biopower's power-knowledge relationships and of strategies and mechanisms for intervention, is humans. Rabinow and Rose also depict their biosocial collectivities in terms of groups of people. This perspective is widened here to include nonhumans as members of populations and biosocial collectivities, and the next section discusses how this can be approached.

Population, biosociality and nonhumans

Foucault's placing of the emergence of biopower in a particular time and space has not prevented many seeing its relevance in other historical and geographical contexts. Although Rabinow and Rose have been critical of some attempts to apply 'biopower' as a general label rather than examining its pertinence to specific phenomena, their set of three elements characteristic of biopower, summarised as "a knowledge of vital life processes, power relations which take human beings as their object, and the modes of subjectification through which subjects work on themselves qua living beings"[20], provides a useful model for such examination. It is noticeable, however, that relatively little attention has been paid to the nonhuman constituents of the power-knowledge relationships constituting incidences of biopower. There are some exceptions, however. Rutherford, for example, makes a case for the extension of the analytics of biopower to cover all life, not just the human, and in a similar fashion, Youatt argues that "the 'bio' in biopower should be taken seriously as involving all of life". Twine has identified biopower as an analytical tool for the exploration of how animal bodies are situated in the knowledge-practices of agricultural biotechnology and we have argued elsewhere that fertile ground for a process of testing the analytical value of biopower is provided by the cases of genetic techniques in livestock breeding and robotic milking technologies in dairy farming[21].

[19] Gibbon and Novas, "Introduction," 3.
[20] Rabinow and Rose, "Biopower today," 215
[21] Stephanie Rutherford, "Green governmentality: insights and opportunities in the study of nature's rule," *Progress in Human Geography* 31 (2007): 291-307; Rafi Youatt, "Counting species: biopower and the global biodiversity census," *Environmental Values* 17 (2008) 409; Richard Twine, "Animal genomics and ambivalence: a sociology of animal bodies in agricultural biotechnology," *Genomics, Society and Policy* 3 (2007) 99-117; Lewis Holloway, "Subjecting cows to robots: farming technologies and the making of animal subjects," *Environment and Planning D: Society and Space* 25 (2007) 1041-1060.

Indeed, it is the very focus of biopower on the 'fostering' of life itself which makes it productive as a possible way for thinking through human-nonhuman relationships which involve the intervention by people in the bodies and lives of agricultural animals. For Twine and for Wadiwel, nonhuman life can be apprehended through the lens of biopower because of its focus on those vital processes – nutrition, reproduction, illness, death - which are common to different forms of nonhuman and human animal life[22]. Similarly, Haraway's understanding of biopower as "the practices of administration, therapeutics, and surveillance of bodies that discursively constitute, increase and manage the forces of living organisms" does not discriminate between the human and the nonhuman[23]. At one level, then, livestock are considerable as populations, or groupings, of one sort or another, which are the subject of power-knowledge relations, are known about in terms of processes, and are intervened on in attempts to steer those processes towards goals of productivity or efficiency, for example. Nonhuman populations can be seen as constituted by the knowledges and interventionary practices defined as relations of biopower. As such, these populations or emergent groupings of livestock can be explored in terms of their territorialized (or other) boundaries, and in terms of associated biosocial collectivities with an interest in managing the life processes of a particular grouping of cattle or sheep.

At a second level, however, Rabinow and Rose's sense of biosocial collectivity can be developed in ways that are not limited to the inclusion only of humans. Collectivity can be conceptualised in ways that allow nonhuman animals to be regarded as members, along with humans, of heterogeneous collectivities. This heterogeneous sense of collectivity draws on the insights of Foucault's writing on biopower in relation to specific types of human-nonhuman relationship, in this case in fields and farmyards and through the knowledge-practices of livestock breeding. Haraway's drawing of different species into complex entanglements[24] suggests the formulation of more relational conceptions of biopower in which people work on nonhuman others as part of their work on themselves. In redefining biosocial collectivities as heterogeneous, it is suggested that the inter-species relationships within collectivities are important in terms of how the fostering of animal life is a joint product of the human and the nonhuman.

The chapter now turns to an empirical examination of population and collectivity, drawing on in-depth interviews with the representatives of ten beef cattle breed societies and eleven sheep breed societies conducted between May and July, 2008. Breed societies in the UK are constituted as charities, and have the fundamental objectives of promoting and 'improving' their particular breeds and registering newly-born animals as members of the breed. Drawing on this research, the following sections explore the effects of genetic

[22] Twine, "Animal Genomics", 99-117; Joseph Wadiwel, "Cows and sovereignty: biopower and animal life," Borderlands 1 (2002) unpaginated.
[23] Haraway, *Modest Witness*, 11.
[24] Haraway, *Modest Witness*; Donna Haraway, *When Species Meet* (London: University of Minnesota Press, 2008).

techniques in livestock breeding on, respectively, the construction of populations and the constitution of heterogeneous biosocial collectivities.

Beef cattle and sheep: constructing populations

A complex array of specific techniques constitutes the field of intervention in the breeding of livestock animals. These include selection 'by eye' (based on breeders' visual assessment of their animals), the use of pedigree and performance records, breed society standards and objectives, artificial insemination, embryo transfer, and the use of EBVs and genetic marker technologies. The techniques are associated with truth claims concerning the relationships between particular sorts of knowledge and the predicted quality of resulting offspring, and these truths are themselves associated with authorities ranging from breeders (whose authority derives from their standing within a breeding community), to breed societies (whose authority is associated with formalised modes of describing and recording animals) and agricultural scientists (whose authority is associated with established modes of producing scientific knowledge).

Although the truth claims being made, and the authorities which are linked to them, are interesting and are key to a conceptualisation of biopower, the focus here is on the different ways in which populations are constituted in relation to different techniques for intervening in livestock reproduction. Again there is a complex array of such populations, intertwined with and constituted alongside various interventions. The different types of population to some extent correlate with a range of both geographical scales and scales of scope. For instance, 'national' populations of animals are described, and this can relate to an entire species (e.g. cattle or sheep) or to national populations of a particular breed of cattle or sheep. The national population of a breed may itself be more complex, understood as a collection of other populations referred to as 'strains', 'types' or 'lines', on the basis of their recorded pedigree. For example, the representative of a large hill sheep breed[25] said that,

> there are three distinct types within the breed, what we call, the Lanark type, the main, the largest number, numerically it is the largest part of the breed, they tend to be the most hill type sheep, they are quite compact and very hardy ... The Perth type is rather larger, but not quite so hardy, they need to be onto some better ground, and then we have got the North of England type ...

At the same time, however, populations can be defined through processes of intervention at both larger and smaller scales. International populations of a breed are particularly important, for example. Yet, even though such larger scale populations are constituted through transnational techniques (e.g. semen/embryo transfer or the movement of live animals), for many breed societies the emergent differences between animals of a particular breed between different national spaces is also important and reflected in the

[25] Breed names have been removed to preserve interviewees' anonymity

reference to distinct *national types*. At the international scale, interventions in livestock breeding are profoundly influenced by the national and international breed associations, by national political and scientific institutions which intervene in the agriculture of their respective countries, and by trade regulations. At the other end of the scale, populations can be defined in terms of the individual flocks or herds established on particular farms, and which are the subject of the interventions of the individual breeder.

Breed is clearly a key signifier – probably the most important as far as those involved in breeding are concerned - in the way that these populations are constituted. Breeds are bound up with sets of truth claims concerning the ability of animals within a breed to 'breed true' when they reproduce, the authority of breed societies to set breed standards and to record pedigrees, and specific interventions such as the maintenance of 'herd books' in the breeding of livestock to ensure, record and construct 'purity' (see below). The breed, in this sense, is constituted as a population delimited by the recorded relationships between sets of individual animals, and between living animals and their ancestors. However, the concept of breed is given new inflections in the light of genetic techniques. Two examples illustrate this.

Estimated Breeding Values

EBVs are produced as a result of the detailed logging of information about individual animals. Raw data are collected by breed societies, and passed to a company contracted to calculate a range of EBVs using a statistical process referred to as Best Linear Unbiased Predictor (BLUP). BLUP determines the probability that an individual animal will pass on particular qualities to its offspring, by relating that individual's data to data collected from its relatives. EBVs can be presented in various ways, for example numerically or graphically, and tend to be combined into more generalised indices such as the Beef Value, which combines EBVs relating to meat productivity, and the Calving Value, which combines EBVs relating to maternal qualities. EBVs and indices derived from them are frequently used in marketing animals at livestock sales, on websites and in breed society magazines. Increasingly, 'good' EBVs add financial value to an animal[26]. They are also used in making decisions about which animals to breed together, with breeders being encouraged to look for animals likely to contribute particular qualities to their herds and the existence of on-line tools that predict EBVs for progeny from hypothetical matings.

As such, EBVs change the ways in which breeds are understood by adding new sets of *processes* to those which are already in place and through which the breed is understood and on which attempts are made to intervene. As discussed above, it is this understanding of populations as sets of processes which, for Foucault, marked a radical change in the power relations governing interventions in lives and life.

[26] Holloway and Morris, "Boosted bodies".

While we do not suggest here that genetic techniques mark the *advent* of process-defined senses of population in livestock breeding (fertility rates, growth and feed conversion rates, etc., have long been core to knowing and managing populations), such techniques can define and measure *new* and *quite different* processes, associated with and producing new modes of intervention. With EBVs, for example, processes relating to ideas of genetic improvement, add new layers of data and foster new possibilities for intervention, redefining what is understood by a breed population. Examples of this are, first, the way in which certain animals come to be referred to as within the top 5% or 10% of their breed population, and second, the ways in which each animal becomes positioned in relation to a breed average, in attempts to normalise the genetic quality of the breed. For example, a continental cattle breed society representative described how,

> You're also looking at the performance figures, these EBV's, estimated breeding values, which again come from, you know, background data from, again, sire and dam, so the more information you've got, the correct accuracy of the figures and also they are measuring different weights at so many days, 200, 300, 400, 500 day weight and that's all ploughed into the system and crunched up. The muscle score is measured, the muscle depth, the fat depth, you know elements like that all go into giving you a figure for an animal. So it is giving you a figure, let's say for a bull, it's giving an estimated breeding value of +40 which puts it in the top 1% of breed or +25 puts it in the top 25% breed and also the dam.

Certainly, then, EBVs seem to foster particular sorts of knowledge and intervention, which are defined, afforded or constituted by the technology of the EBV system. The following comment from a cattle society emphasises this way of thinking in relation to breeding.

> I don't think anybody looking into the future in the beef industry, you can't go forward without knowing the genes, the genetics. I mean just to go on appearance and colour I think is a joke.

EBVs *reinforce* the notion of breed, as the technologies used can only develop comparisons *within* existing breed populations; breeding values cannot be compared across breeds. They may also emphasise the differences *between* breeds, as, for instance, one breed society representative argued that the available EBV systems, as provided and marketed by commercial institutions, were oriented towards larger and faster growing animals than those of the breed he represented, which instead focused on meat quality based on slow growth.

Genetic markers

Genetic markers, which work on the basis of the identification of actual genetic material in individual animals, are not dependent on breed relationships at all and potentially

have more radical implications for breeds. This point was made by one cattle breed society representative, who felt that his breed had been unfairly criticised for being associated with a particular inherited 'problem'; "we've said that you can't be breed specific, you've got to be specific to the genetic problem, right. The genetic problem is the double muscled animal which is carrying the myostatin gene … and that includes native breeds"[27]. The argument here is that the focus needs to be on the presence or absence of specific genetic material in *individual animals*, regardless of the reputation of their breeds.

Genetic markers, then, have the potential to destabilise the need for breeds as populations altogether. In some scenarios at least, there may be little need for *breeds* as a guarantee of pedigree and 'quality', and instead *individual* animals may be understood and managed in relation to the presence or absence of specific genetic material. Merial, for example, a company marketing marker tests, claims to have identified markers which could be used to alter breeding programmes and animal management. As Merial claims via its website in relation to its IGENITY marker test,

> The addition of analyses related to feed efficiency makes the comprehensive IGENITY profile more powerful to help producers make better decisions about their cattle and help reach their goals faster … Producers can get inside information about traits such as quality grade, fertility and now feed efficiency that are essential to profitability in the beef industry — all from a single DNA sample.[28]

In this way, new populations, associated with new processes of genetic relationality and corporeal management, and with trademarked tests for specific markers, might be constituted.

Yet the idea that breeds might become less significant in the face of genetic markers was actually not the sense gained from breed society representatives, perhaps not surprisingly. Where markers were discussed by breed society representatives, they were regarded as offering potential additional tools for intervention within existing breed population structure. They might, for instance, be incorporated within EBVs as so-called 'Molecular Breeding Values' (MBVs). Markers might thus produce new truths, new forms of molecular authority and other inflections of the notion of breed population, through the deployment of such interventions.

The genetic techniques described here are heavily reliant on systems of measurement, recording and statistical processing. These techniques are thus important in the constitution of the processes which themselves define the livestock populations under discussion. They both

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[27] Myostatin is a muscle growth regulator. Deficiencies in myostatin, which are associated with particular markers, can produce 'double muscling' in cattle: this may be sought, as it leads to production of more meat, but it can also cause problems such as difficult calvings.

[28] Merial IGENITY "http://www.igenity.com/news/pressreleases/June30-2008-1.aspx." Accessed July 25, 2008.

represent these processes (through, for example, tabulated or graphically-presented data showing change in a breed population's 'performance' over time) *and* produce those processes in the first place in the way that only certain bodily characteristics or performance indicators are attributed with a value that makes them worthy of measuring. The specific piece of data known as '400 day weight', for example, is constructed as knowledge which is worth having, and as data on the 400 day weights of many animals are accumulated and presented in various ways, a process of genetic variability and change within a population can be mapped. Again, this is not new: breeds are founded on meticulous recording and documentation, of ancestry in particular, and breed 'improvement' has long been associated with records of animals' productivity. But we can identify an intensification and increasing complexity here in terms of the amounts of data generated, processed and deployed in the breeding of livestock, often through an international network of institutions, associated with new contours of knowledge surrounding how breeding is conducted. In turn, this is likely to affect how breeders 'see' and relate to their animals, changing the criteria upon which they make breeding decisions to take account of these 'new' forms of knowledge produced within international networks of recording, calculation and prediction.

EBVs and genetic markers suggest that new truths are being produced about livestock animals by authorities increasingly positioned to be able to make such truths powerful in breeding practices, hence changing to a greater or lesser degree the scope of interventions possible in livestock breeding. Livestock populations, in particular breeds, may be both reconfirmed and challenged as this happens. EBVs, for instance, are partly a new technique applied to an already existing population, but the sense of population and the processes it is known through change as EBV techniques are deployed. In this way a population is not just a group of animals but a set of processes which can be intervened in, in attempts to guide them in particular directions while acknowledging that this guidance is highly problematic and uncertain, given the complexity of the processes and the animal bodies under consideration.

In the next empirical section, the focus shifts from populations to the biosocial collectivities associated with livestock breeding and the constitution of particular populations of animals, paying particular attention to first, the way that they can be considered as heterogeneous, and second, the particular effects such collectivities have on the lives of both humans and nonhumans.

Biosociality, collectivities and livestock breeding

Key to an understanding of breeds as heterogeneous biosocial collectivities is the breed societies themselves, along with the specific mechanisms deployed by breed societies to establish and record breed membership – in particular, the herd or flock books in which populations are enumerated. These books are regarded as authoritative carriers of truths about their particular breed (often literally referred to as 'bibles'), whose active presence is a part of breed societies' efforts to construct and represent a population's 'purity'. The purpose of the breed society, one sheep breed representative said,

> … is partly to safeguard the integrity of the breed, if you like. I mean, there is a very detailed description of the breed laid out in our constitution ... the breed is very pure, and has had nothing introduced to it and that has been maintained by the constitution.

Herd/flock books might as such be regarded as a technology; they have a material existence, purpose and effect on a livestock population. Yet these documentary technologies are also hybrid, since they list and associate both humans and nonhumans. The same sheep breed representative said of his flock book,

> It contains the details of every animal which has entered the flock, male or female, and details of all the members, council members, the annual reports and finances of the society and all that sort of thing.

This list, of animals, humans and other sorts of records and data, begins to map out a heterogeneous biosocial collectivity. This makes herd and flock books powerful instruments for interventions in the lives of animals *and humans* because they bring together and record animal populations, and form the basis for a lot of decision-making in livestock breeding. Authority and truth emerge from these heterogeneous, trans-species relationships. The following comments from the representative of a large breed society which had grown from a position in the 1960s where the breed had almost disappeared highlight this, as truths about a breed identity are constructed and a new institution is created which embodies and enacts those truths.

> ... by 1964 the situation was really bad and there were only about half a dozen serious breeders left. They got together and they decided they had to do something, so they went around and *identified what they regarded as true* [breed name] and there were about six or seven hundred of these, that was all that was left, and *they made a concerted effort about 1971 they set up the [breed name] Society which was based on those six or seven hundred sheep that they identified.* There were no records or anything, so they were the founding [breed name] sheep. (emphasis added)

Breed societies as biosocial collectivities are important then in their interventions in livestock breeding. As well as maintaining herd or flock books, they also define in material, bodily terms just what the members of a population should be like. The representative of a smaller cattle breed society, for example, said that,

> The breed improvement committee has a couple of meetings a year ... We have a tight classification system ... [where] ... on visual inspection, an animal is pointed for various

> different things, breed character, conformation, mobility, temperament and the score accordingly is munched into a computer and comes out with an average score.

These processes of inspection and classification do not merely describe. They are active interventions in the joint lives of breeders and animals, potentially affecting in complex ways exactly which animals are bred to which, and which animals are considered to be legitimate members of particular breed populations. This can, too, be seen in the references made to genetic techniques in attempts to guide breeders' breeding practices. Here, a cattle breed society representative describes an attempt to intervene in breeding decisions;

> Well what we say is that we've got a responsible guide to calving management. This is our responsible guide to selection of sires which kicks back to genetic evaluation ... what we're trying to do is to pull our calving stats[29] down to the bovine norm for the pedigrees.

Within biopower, processes of normalisation in relation to populations are crucial modes of intervention[30], and here are identified attempts to normalise one population – the breed in question – in relation to another population – the bovine species – in attempts to deflect criticism that the breed experiences more 'problem calvings' than is acceptable. In this case, both the animals (in terms of their corporeal characteristics), and the breeders (in terms of their judgements and decisions) are acted upon through the breed society's attempts to guide processes of breeding future generations of livestock.

Similarly, other modes of intervention can be recognised as the products of the heterogeneity of breed societies. A sheep breed society representative referred to the power breeders had to foster the perceived malleability of animal bodies, suggesting an almost unlimited ability to intervene in and transform bodies and lives.

> … with five years breeding we could make something that looks like a Texel and had a hundred and forty percent lambing, or we can make something which is sixty kilos but doing, hundred, no probably two hundred and ninety percent lambing. We got all these bloodlines in the breed … There is nothing that we know of currently in terms of breeding that's a real problem for us to achieve.[31]

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[29] i.e. the percentage of cows suffering difficult calvings.

[30] Foucault, *Security, territory, population*.

[31] The Texel is a large 'terminal sire' used to produce meaty lambs in a cross-breeding programme. Lambing percentages refer to the mean number of lambs produced per hundred ewes: a 290% lambing percentage would mean that on average 100 ewes produced 290 lambs per year – a very high rate.

Here, the heterogeneity of the breed society biosocial collectivity is emphasised by the particular sorts of human-nonhuman relationship enacted through such statements about the power-knowledge relations being played out in livestock breeding practices.

As with populations, particular ways in which new genetic interventions in livestock breeding are transforming heterogeneous biosocial collectivities can be identified. For example, the knowledge relationships afforded by these interventions provide novel inflections on breed societies and herd/flock book records, and indeed, reliable and accurate record keeping is essential to the functioning of these new interventions. For example, a large sheep breed society representative reported on the history of particular schemes for 'improving' animals:

> It started off, there had been a group of us, I guess about 24, 20-24 members in a breeding group that was set up, called the sire reference, the [breed name] Sire Reference Scheme. They have renamed themselves this year Premier [breed name] Breeders and we've been using EBVs and indices … [for] a good twenty years, anyway we've been as a group using EBVs and in that time we've managed to get fat levels down and, if I'm being realistic, the sheep that have got at times, say 5-6 years ago that had very high final index scores were probably too lean.

Such comments, which name and entangle humans and sheep, emphasise that interventions in the lives of domestic livestock emerge from the heterogeneous relationships constituted by and constituting breed societies as biosocial collectivities. The objectives referred to, such as reducing fat levels, simultaneously represent strategies for intervention in animal lives and require the establishment and maintenance of formalised relationships, here institutionalised as named groups, between breeders, and between breeders and livestock animals. The comments also indicate the complexities of such interventions which are reliant on genetic indices. As the interviewee suggests, it was possible to go too far and have the unintended consequence of sheep which were too lean. Further, they point to the way in which such interventions are also to do with the construction of subjectivity and identity. To be a 'Premier Breeder' a breeder needs to engage with genetic knowledge-practices, and to intervene in particular ways in the lives and bodies of their sheep, in ways which mark them out as more 'progressive' than 'ordinary' breeders.

Each breed society and its annually-published herd or flock book can thus be seen as the nexus of a set of power-knowledge relationships crucial to the relations of biopower evident in livestock breeding. At one level, they establish and map out a breed as a population, showing which individual animals are formally registered as pedigree members of the breed and how they are related to each other. But at another level they are co-produced along with associated populations, represent truths about populations, act as authorities in relation to a specific breed, and are essential to attempts to intervene in the processes constituting breed populations. Finally, at a third level, breed societies herd animals and

humans together, herd or flock books tie humans to animals by their detailed listings of animals *and* breeders, emphasising the ineluctably close relationships between them; they are records then of heterogeneous biosocial collectivities. Genetic techniques are producing new inflections to these relationships, reconstituting these heterogeneous biosocial collectivities as these new modes of intervention affect how animal bodies are known and worked with.

Conclusions

Livestock breeding can be seen as a series of moments and spaces in which species meet[32]. Most obviously, humans intervene in the lives of nonhuman animals, transforming their bodies and experiences in sometimes quite radical ways. The new genetic techniques discussed herein are only the latest in a long series of interventions aiming to invest the lives of livestock and guide the processes constituting livestock populations.

Foucault's concept of biopower can be a powerful analytical tool in relation to nonhumans. In particular, the focus of biopower on life itself makes it extremely relevant to livestock breeding, and it is possible to identify specific sets of power-knowledge relationships. Within these, truths about the life of livestock are articulated and put into practice, centred around the continuing investment in animal life. As such, then, Foucault's emphasis on the constitution of particular populations, which are known about and intervened on in particular ways, relates directly to the production of different groupings of livestock at different scales. These populations are not simply predefined, but within the biopolitics and biogeographies of livestock breeding they co-emerge with the interventionary techniques, both shaped by and shaping the techniques over time.

At the same time, livestock breeding can be seen as a process of co-producing humans and nonhumans, and as it has been argued here, building on Rabinow and Rose's terminology, heterogeneous biosocial collectivities which include humans and livestock animals. These collectivities are, too, co-produced within particular biogeographies, incorporating animal and human bodies along with sites such as farmyards, agricultural showgrounds, breed society offices and herd/flock books. Developing this sense of heterogeneity in relation to biosocial collectivities is important in the first instance because it emphasises co-production within collectivities which are active in the sense that they have particular purposes and constitutions. They are also active in constituting populations, that is, in delimiting the membership of groupings which are subject to particular interventions and which are known in particular ways. Heterogeneity is also important in helping us to begin to deal with a key element of Rabinow and Rose's conceptualisation of biopower – subjectification. While arguing that nonhuman animals can experience the same processes of reflexive, self-disciplinary subjectification that humans (according to Foucault's theorisation) do is problematic, if the hybridity of collectivities such as breed societies is accepted, then it is possible to move towards developing understandings of a decentred, or distributed

[32] Haraway, *When Species Meet.*

subjectivity, in which disciplinary and subjectification processes act on livestock breeders and livestock animals *together*. A more heterogeneous understanding of biopower in relation to livestock breeding is therefore produced, in which its power-knowledge relationships are important in their simultaneous subjectification of humans and material effects on livestock animals. Relations of biopower are not new in agriculture. However, biopower is not a generalisable, unchanging structure, instead its relationships take specific forms in relation to particular moments, geographies, sites and cases. Thus, the particular focus on the notion of 'population' in this chapter demonstrates the specificity of biopower to particular biogeographical circumstances. That is, populations are effected differently in relation to different breeding techniques and different scales of analysis, for example. Two final points follow.

First, in relation to genetic techniques in livestock breeding a particular mode of biopower is emerging, analogous in many ways to the forms of biopower described by Rabinow and Rose regarding biomedicine[33]. Genetic breeding techniques are associated with, *inter alia*, particular ways of knowing animals, particular types of scientific expertise in relation to breeding, an emergent biogeography associated with genetics organisations, and particular constructions of, and interventions in, animal populations. This marks them out as being established within different power-knowledge relationships as compared to other knowledges and interventions. This is evident, for example, in the new institutional relationships surrounding genetic involvement in livestock breeding, and the new ways of measuring and representing 'improvement' by which the processes constituting livestock populations are known. Yet at the same time, genetic techniques have not simply supplanted more 'traditional' modes of relating to livestock animals. Both provide inflections on the other, and there are fierce debates in breed societies and elsewhere about the relative merits of, for example, EBVs and visual selection.

In relation to this the second point is that emerging modes of biopower in livestock breeding do not supplant *other* modes of power relationship. Indeed, Foucault is clear that 'earlier' modes of power, such as sovereign power or disciplinary power, do not disappear in the face of an emergent biopower, but that instead they may re-emerge in new forms in relation to biopower. In the case of livestock animals, the *absolute* power that humans have over their lives and deaths is all too evident in particular agricultural practices[34]. And returning to earlier comments on subjectification and heterogeneous biosocial collectivities, attempts by breed societies and other institutions to discipline breeders into thinking about, and acting on, livestock animals in particular ways are identifiably part of the co-constitution of the identities and bodies of humans and livestock, as are the possible modes of resistance or counter-conduct which challenge the increasing dominance of geneticisation in livestock

[33] Rabinow and Rose, "Biopower today".

[34] Lewis Holloway, Carol Morris, Ben Gilna and David Gibbs, "Choosing and rejecting cattle and sheep: changing discourses of (de)selection in pedigree livestock breeding," *Agriculture and Human Values* 28 (2011): 533-547.

breeding[35]. The very material effects of new genetic techniques are thus tied to processes of subjectification within heterogeneous relations of biopower.

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