

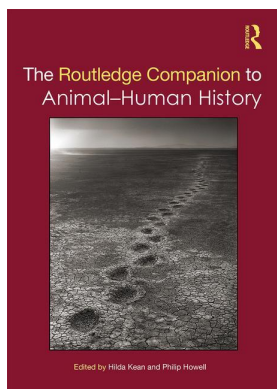
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BREEDING AND BREED

Neil Pemberton, Julie-Marie Strange and Michael Worboys

Introduction

With respect to animals, the word breeding is both a verb and a noun. The verb refers to their reproduction and is used for both wild and domesticated species. The noun refers to animals *with* breeding in the sense of pedigree heritage and selection for specific properties that has produced the division of many working, farm, fancy and pet species into ‘breeds’. These are animals that have been actively created by livestock producers, fanciers and other breeders to suit to human requirements for companionship, food, sport, work, fancy and other purposes. However, modern breeds are much more, especially in livestock and dogs, which have been bred to meet specific standards of shape, size, colour and other external features, and are presumed to have a superior inheritance given by their ancestral lineage from pure-bred stock. Both uses of the term have been applied to humans: the verb in a mostly derogatory manner to the lower classes, especially those with large families who have been said to ‘breed like animals’; while the noun, perhaps perversely, was used for upper-class individuals who came from ‘good families’ or ‘good stock’, where the presumed quality of biological inheritance mirrored the quantity of inherited wealth.

The founder of eugenics, Francis Galton, pondered in 1864:

If a twentieth part of the cost and pains were spent in measures for the improvement of the human race that is spent on the improvement of the breed of horses and cattle, what a galaxy of genius might we not create! We might introduce prophets and high priests of civilization into the world, as surely as we can propagate idiots by mating *crétins*. Men and women of the present day are, to those we might hope to bring into existence, what the pariah dogs of the streets of an Eastern town are to our own highly-bred varieties.¹

It was twenty years before he developed these ideas into the ‘science’ of eugenics and not until the early twentieth century that this became a movement and the

differential birth rate of different social classes and races became political issues. However, there was a close connection between ideas, though not the practices, of animal breeding with human reproduction. There were taboos against marriage to close relatives, which in animals was termed inbreeding, and fears about miscegenation, which had parallels with ideas of the weaknesses of animal hybrids.

In this chapter we discuss the history of the breeding of domesticated animals and how this practice produced varieties of animals with 'breeding', and that since the late-eighteenth century have been termed 'breeds'. We do not consider the long history of domestication in animal-human relations, which archaeologists date back 20,000 or so years, but begin instead in the eighteenth century, when the principles of selective breeding were first systematised.² Moreover, over the past two hundred years the degree to which animals have been altered and the speed of change has increased greatly, and this is not without consequences for animal health and well-being as 'breed populations' have become more uniform genetically and their characteristics more finely graded. Historians agree that the pioneer of 'scientific' breeding was Robert Bakewell, a farmer from Leicestershire in England, whose ideas for improving sheep, horses and cattle were widely publicised and taken up across Europe and North America.³ Historians have questioned his status as the founder of modern livestock breeding and now point to a longer time frame of selective breeding and to the work of other eighteenth-century improving farmers, many of them obscure.⁴ We consider the evolution of ideas on selective breeding through the nineteenth century and end with an assessment of the impact of the ideas of Gregor Mendel and the science of genetics in the twentieth century. From the eighteenth century, breeders have continually claimed to be making their enterprise 'scientific', yet at the same time, and with equal fervour, they have asserted that it was also an 'art' that relied upon tacit and incommunicable knowledge. This ambivalence runs through the history of breeding to the present day. The notion of 'breeds' was first developed with livestock and then transferred to thoroughbred horses, poultry and pigeons, and then to domestic dogs and cats. Breed embodied contemporary assumptions about heredity that are captured in terms such as 'purebred', 'bloodline', 'pedigree', 'inbred' and 'mongrel'. However, there is also something modern about the term. The physical form of breeds as standardised, uniform animals, broken down into points or parts, was in many ways analogous with industrial invention, design, standardisation and manufacture.

Historians of agriculture and science have discussed breeding most, though there is a growing body of work, principally by literature scholars concerned with the twentieth and twenty-first centuries, on the meanings and uses of inheritance, mostly about humans, but also exploring animal analogies.⁵ Historians of science have been particularly interested in the ideas of the nature and consequences of inheritance in the work of Charles Darwin and Gregor Mendel.⁶ Darwin, because of the importance of 'artificial selection' in the articulation of his theory of natural selection and his authoring of the two-volume work *The Variation of Animals and Plants under Domestication* published in 1868.⁷ Mendel, because his plant-breeding studies were central to the establishment of genetics in the first decade of the twentieth century and there is now a substantial literature on its applications in breeding new plant varieties.⁸ What little work there is on post-Mendelian animal breeding

indicates that the impact of genetics was mixed.⁹ There are many reasons for this, and the biological ones are important: the inheritance of specific characteristics in mammals is complex and does not reduce readily to simple genetic laws as in plants, while practically the lengths of their gestation and time to adulthood gives a further level of complication. In the twentieth century, the most important innovation in animal breeding was the increased reliance on artificial insemination with certain livestock and poultry, a practice that, of course, has had consequences for genetic diversity.¹⁰

The seminal work in the history science on animal breeding before Mendel is by Vitezslav Orel and Roger Wood on sheep breeding, which has revealed the depth and breadth of interest in animal breeding amongst central European zoologists and livestock breeders from the early nineteenth century.¹¹ Interestingly, this was influenced by Bakewell's work and in turn was an indirect influence on Mendel. Also seminal is Harriet Ritvo's *The Animal Estate* and her many essays on animals, which although largely on the nineteenth century, have shaped scholarship in other periods. Their work is now complemented by several monographs by Margaret E. Derry, which are interdisciplinary and span the period from the eighteenth to the twenty-first century.¹² She combines histories of science, livestock, professional and amateur breeding, and the economic history of commercial and fancy breeds with strong narratives and insightful analyses. Derry has shown the importance of continuities in genetics from the biometrician tradition, the early twentieth-century alternative to Mendelism, which stressed continuities in inheritance, rather than the discontinuities that Mendelians focused upon, and analysed these mathematically.¹³

In agricultural history, there are relatively few studies of livestock farming compared with the production of arable crops, such as corn, wheat and maize. Unfortunately, there is no equivalent for later centuries of Nicholas Russell's excellent study of heredity and animal breeding in early modern England.¹⁴ For later centuries, agricultural historians have studied particular breeds, but their focus has tended to be on the livestock economy and the outcomes of selective breeding, not the inputs.¹⁵ There are histories of specific breeds of livestock, often written by breeders themselves, which are rich sources of information and insight into breeding practices.¹⁶ The best work in literary scholarship is typified by Jenny Davidson's *Breeding: A Partial History of the Eighteenth Century*.¹⁷ She shows that in discourses of the period, breeding was 'an umbrella term that can refer to nature or nurture, generation, pregnancy, hereditary resemblance, manners, moral character, social identity, or all of the above' and that resonated across species in a predominantly agricultural economy and when pets were becoming more common.

Much of the Animal Studies literature has criticised the subordination of animals and the material effects of the institutions and practices belonging to the social and commercial world of breeding and, in doing so, has argued for different and, in their view, more ethical ways of living with animals.¹⁸ It is interesting, therefore, that there is relatively little work on the invention of 'breed' as a way of thinking about animals, and of physically remaking animals to standards dictated by a range of factors. However, there are two recent exceptions. Martin Wallen's history of foxhounds, which adopts an Animal Studies approach and *The Invention of the Modern Dog: Breed and Blood in Victorian Britain* by the authors of this chapter.¹⁹

Breeding animals

The breeding of domesticated animal varieties over the past 20,000 years has been both unintentional and deliberate. The unintentional creation of varieties occurred due to the geographical isolation of different human populations and the adaptation of their animals to different environments and uses. Had such isolation been for longer and been stricter, it is likely that the differences between domesticated varieties would have widened and they would have become distinct species. Biologists call this process speciation and typically it takes much longer, hundreds of thousands, if not millions, of years, than the 20,000 years of domestication. Thus, despite the often huge differences in the size and form of dogs, for example, with the Great Dane and Chihuahua, they remain the same species and can interbreed, though in the case cited that would require artificial insemination and Caesarean delivery. The essence of Darwin's theory of evolution by natural selection was that species could change (transmutation), but that the process was gradual and occurred over an extended period of time. Two ideas that he was arguing against were: first, the religious view that species were God's creations and fixed; and second, the views, associated with the French natural historian Jean-Baptiste Lamarck (1744–1829), that species could change quite quickly by the inheritance of acquired characteristics.²⁰ Darwin wrote extensively on inheritance to explain how the features that 'nature selected' were passed on from generation to generation, though his ideas have not been discussed to the same extent as his main evolutionary theory, because they never gained the same support and were soon superseded.

Lamarck was a follower of Georges-Louis Leclerc, Comte de Buffon, who dominated eighteenth-century French natural history. Buffon argued that the fixity of species was demonstrated by the infertility of hybrids, which was congruent with the view that all animals (and plants) were God's Creation and directly or indirectly fitted the purposes of humanity. However, the century was also the high point of the Enlightenment, which emphasised the power of environmental forces (*climat*), of nurture over nature, and the possibilities of improvement. These ideas were influential in the French Revolution, which challenged inherited power and property and sought the reordering of society. However, in science, medicine and animal breeding there was a growing recognition of one limiting factor on change and improvement in the natural world – inherited, often fixed, features. In the nineteenth century this became known as 'heredity', but earlier was most commonly referred to as the influence of blood or seed. In the humoral model of the animal body, eggs and semen were formed from the blood, hence, it carried properties of the parents to their offspring. Orel and Wood have argued that the first scientific discourses on the influence of blood as a hereditary material were about the inheritance of diseases and abnormalities, which raised questions about the perfectibility of nature. More importantly for animal breeding, Orel and Wood argue that 'scientific' selective breeding began with efforts to avoid such defects rather than improve features in both medicine and the livestock economy.²¹

The inheritance and expression of abnormalities raised questions about accepted ideas of reproduction and generation. In animals there were two main ideas: offspring were preformed in the female and the process of growth was initiated by sexual

intercourse or semen; or that the development of generative material in the female was started and shaped by semen. In both models, reflecting ideas that can be traced to Aristotle, the role of the female was passive and the male active, though mothers influenced their offspring during gestation and feeding. Another tradition, associated with Hippocrates and Galen saw generation coming from the mingling of female and male semen, with equal though different contributions, indirectly, from the blood of both parents. The physical and mental similarities between parents and the children had long been recognised in the truism that 'like beget like', but there were no clear patterns. In humans, there was sometimes a striking resemblance to one parent, sometimes to a grandparent or other relation, and sometimes to no one. The same was observed in animals, and, in dogs and cats, seen in the variety within the same litter and explained by the influence of the environment on offspring before birth and throughout life. Some natural philosophers puzzled over these matters, but without a concept of heredity they focused on environmental factors, which they could measure and alter, and worked around the serendipity of 'blood'.

Breeding livestock

The great change of views on inheritance came not from science or medicine, but from sheep breeders, first, with responses to the introduction of the Merino sheep from Spain into northern Europe, and second, with the work of Robert Bakewell and his improved New Leicester breed. Merino wool was highly valued because of its fine properties and many attempts had been made to establish the sheep outside of Spain, but these had failed seemingly due to climate.²² However, in the eighteenth century there was more success and this raised doubts about the overriding influence of climate, suggesting that 'blood' (nature) was as important as climate (nurture). Bakewell also recognised the importance of 'blood' and sought to improve sheep by selective breeding between sheep with the desired qualities. He used cross-breeding between varieties, and breeding between closely related animals: *inbreeding* if between very close relations and *line breeding* if between more distant relations, often between generations.

Bakewell's aim was to create sheep that grew quickly and produced more meat and better Merino-type wool. He travelled around the country buying animals with the right qualities for breeding, recording in detail pedigrees, weight gain, meat quality, and the ability of parents to pass on qualities to their offspring – progeny testing. He wanted not just outstanding individuals – the goal in thoroughbred horse breeding, but consistency and uniformity across the populations of the types he produced. For these qualities he popularised the term 'breed'. Bakewell was initially successful with his New Leicester or Dishley sheep, but also sought to improve longhorn cattle and horses.²³ His principles were used by other breeders, notably Charles and Robert Colling, to create the shorthorn breed, which became important in English farming and was exported to America. In 1822 a public herd book was published, which encouraged breeding by pure bloodlines, indicated by pedigree, as well as by utility, indicated by conformation and potency.²⁴

Bakewell had relied first on out-crossing with sheep from other countries, but once he had achieved his goal he switched to inbreeding. The turn to inbreeding was

controversial amongst breeders as it was associated with deterioration and the converse of, so-called, hybrid vigour. There were obvious links to social mores and rules. Marriages between two very close relatives were taboo in most human societies, though given the size of most settlements and limited movement, marriages to relatives, such as first and second cousins, were not uncommon. In Europe, marriage to very close relatives was prohibited by the main religions. There were cultural reasons for these strictures, but they were also based on biology, as in some such marriages the children were weak or suffered from disabilities. Animal breeders carried over the strictures and also had the experience that inbreeding produced weaker stock. Bakewell claimed the opposite; that inbreeding consolidated and locked in desirable traits. He also argued that the contribution of both parents was equal, though the contribution of the father was easy to assess. In sheep, a ram could be 'progeny tested' with many of the ewes in a single season, whereas a ewe could be 'progeny tested' with only a single ram each season.

Bakewell's ideas were spread by the success of his breeds in sales and the demand for rams to hire across the country and in the writings of the influential agricultural campaigner and reformer Arthur Young.²⁵ In 1809, Sir John Saunders Sebright published a pamphlet on *The Art of Improving the Breeds of Domestic Animals*, which reasserted the dangers of inbreeding as it consolidated both good and bad points. He argued that enthusiasts had exaggerated the value of both inbreeding and cross-breeding and that the true 'art' of breeding was in selection. Unsurprisingly, Darwin used Sebright's ideas in his discussion of artificial selection and particularly his view that 'the weak and the unhealthy do not live to propagate their infirmities'.²⁶ Sebright's experience was that mating the best male and female rarely produced the best progeny, but rather it was the selection of the individuals that 'nicked' to produce the best. Thoroughbred horse breeders had long practised such matches, seeking the best combination of the light, fast, often nervous Arabian stallions with solid English mares that had 'substance'. Sebright also argued that breeders should not only judge by appearances, but also interrogate pedigrees and the qualities that 'have prevailed in the race from which they are descended, as they will always show themselves, sooner or later, in the progeny'.²⁷ In some domesticated animals this information would be found in pedigrees, which were kept privately. There had only been a public stud book for racehorses, published through the Jockey Club since 1791, but this was initially about identity and avoiding fraud rather than a resource of hereditary history. The ideal breeder's gaze, however, was to look at an animal's past, as evidenced in its pedigree; its present, as seen in its physical appearance; and its future as revealed in progeny testing.

The principles articulated by Sebright and others in the early nineteenth century were taken up by the breeders of 'fancy' animals, those bred for showing as much as, if not more than, for commercial purposes. The two were not exclusive, as Ritvo has shown in her discussion of pedigree bulls.²⁸ Fancy breeding as such was first developed with poultry; indeed, the Sebright Bantam was one of the first such breeds. The breeding of other small domestic animals and pigeons followed, with fancy breeding clubs and exhibitions growing rapidly after mid-century, a development favoured by the growth of leisure, the vogue for exhibitions and the rise of competitive sports.

The breeding of dogs, both sporting and non-sporting, attracted the largest number of breeders and the biggest audience at exhibitions. Consequently, it is through dogs that the principles and practice of animal breeding in the second half of the nineteenth century is best followed.

Breeding dogs

The most popular and influential book on dogs in the third quarter of the century was *The Dog* by John Henry Walsh, who published under the pseudonym 'Stonehenge'. The chapter on breeding remained unaltered from the first edition in 1859 to the fourth in 1879.²⁹ He set out six axioms that bring together the wisdom of practical breeders and some insights from science. Walsh had qualified as a doctor and was an early editor of what became the *British Medical Journal*. His 'facts' are worth quoting in full:

- 1 The male and female each furnish their quota towards the original germ of the offspring; but the female over and above this nourishes it till it is born, and, consequently, may be supposed to have more influence upon its formation than the male.
- 2 Natural conformation is transmitted by both parents as a general law, and likewise any acquired or accidental variation. It may therefore be said that, on both sides, 'like produces like'.
- 3 In proportion to the purity of the breed will it be transmitted unchanged to the offspring. Thus a greyhound bitch of pure blood put to a mongrel will produce puppies more nearly resembling her shape than that of the father.
- 4 Breeding in-and-in is not injurious to the dog, as may be proved both from theory and practice; indeed it appears, on the contrary, to be very advantageous in many well-marked instances of the greyhound, which have of late years appeared in public.
- 5 As every dog is a compound animal, made up of a sire and dam, and also their sires and dams, &c, so, unless there is much breeding in-and-in, it may be said that it is impossible to foretell with absolute certainty what particular result will be elicited.
- 6 The first impregnation appears to produce some effect upon the next and subsequent ones. It is therefore necessary to take care that the effect of the cross in question is not neutralised by a prior and bad impregnation. This fact has been so fully established by Sir John Sebright and others that it is needless to go into its proofs.³⁰

Walsh was clear that the bitch was most important and valuable to the breeder, not only because she carried and suckled her progeny, but economically as she 'usually continues to be the property of the breeder, while the sire can be changed each time she breeds'.³¹ By contrast, for the scientist interested in the principles of breeding, the male was more valuable as the results of an individual's mating with many females could be observed and repeated over many generations.³²

The importance of knowing bloodlines was evident in that grandsires and gandsams also have an influence; indeed, Walsh pointed out that often features of the seventh generation back on the dam's side could show in puppies. Walsh followed most breeders in stating that inheritance showed both the blending of characteristics and 'dominance':

There is a remarkable fact . . . which is that there is a tendency in the produce to a separation between the different strains of which it is produced, so that a puppy composed of four equal proportions of breed represented by A, B, C, and D, will not represent them all in equal proportions, but will resemble one much more than the others.³³

This phenomenon was also evident 'in relation to the next step backwards, when there are eight progenitors', where it was termed 'throwing back'.³⁴ On inbreeding he observed that,

Like many other practices essentially good, in-breeding has been grossly abused; owners of a good kennel having become bigoted to their own strain, and, from keeping to it exclusively, having at length reduced their dogs to a state of idiotcy (sic) and delicacy of constitution which has rendered them quite useless.³⁵

The value of breeding in-and-in lay in concentrating 'blood' to give a 'pure breed', dogs that were most likely to pass on their features. Walsh recognised, accepted and, to an extent, recommended crossing, even detailing where breeders were to go for particular characteristics:

Thus, speed is typified in the greyhound, courage in the bulldog, and nose or scenting power in the bloodhound; for hunting purposes, the pointer or setter, when required in conjunction with setting and the spaniel or terrier, for finding or 'questing' both fur and feather. Lastly, sagacity is displayed in the poodle, Newfoundland, and terrier, chiefly because they are the constant associates of man.³⁶

This listing shows that Walsh's interests were primarily sporting, though he also was clear that crossing readily altered size and form; for example, greyhound crosses had lightened the 'heavy form of the bulldog'.³⁷

On questions of 'blood' and its 'purity', dog breeders looked to a pamphlet published in 1874 by William Tegetmeier, the doyen of fancy poultry breeders, and Dr William Whytehead Boulton, a general practitioner from Beverley in Yorkshire, who bred Cocker Spaniels.³⁸ Boulton had produced a kennel of jet-black spaniels that bred true to colour 'generation after generation'.³⁹ Black spaniels, later renamed Field Spaniels, had become the dominant type of spaniel at dog shows; however, their dark colour made them unsuitable for the field where they were hard to spot. As the creations of dog shows, their status was much debated; sometimes they were considered a strain and sometimes a 'breed', though critics

regarded them as ‘mongrels’. Vero Shaw quoted a leading breeder, a Mr Jacobs, on the question:

Much has been written and said on the purity of the breed, deprecating the means I have adopted to produce them as calculated to alter a presumed type, and frequent missiles have been hurled at me and my dogs from behind the hedge. But where is the purebred Black Spaniel so much talked about? Proof of the existence of the purebred one (if ever there was one) has not been forthcoming; like most other sporting dogs, they are the result of different crosses.

We may keep to one strain for many years, and, in time, call them a distinct breed, but what is the result?

To preserve that strain we must continually breed in-and-in to one family, until we get them difficult to rear, weedy, and devoid of sense, when they become useless for the purpose they are required. Therefore breeders have to resort to the crossing with another family, which may be of a different type or colour; by doing so you raise a great ‘hubbub’ and cry that your dogs are not pure. In spite of these cries I followed my own dictation; my great aim was to improve the breed of Spaniels.⁴⁰

Jacobs concluded that he was still seeking ‘improvement’ and that while he had produced dogs that ‘eclipse everything I have yet seen’, he was still to reach ‘the standard I have marked out for my beacon’.⁴¹

Breeders sought and claimed to have purebred animals because they assumed inbreeding gave prepotency, that is, it was more likely and happened more consistently that the parents’ features would be reproduced in their offspring. Such dogs and bitches had higher sale and stud values, especially if the breeder was trustworthy on a dog’s pedigree. However, there seemed to be no justification in science for the notion of ‘pure bred’, especially if one followed Darwin and his work on the domestication of animals and plants. Tegetmeier was Darwin’s most influential populariser with breeders and in his *The Poultry Book*, published in 1867; he used rabbits as an example:

[I]n the strictest scientific sense of the word, no particular variety of rabbit can be said to be a pure breed, as, like all others, it is descended from the wild original. In the same manner, we may deny the applicability of the term pure breed to the variety of any domesticated animal, even if, as in the case of the dog or sheep, we do not know the original from which they descended.⁴²

Tegetmeier was drawing upon the distinction, vital to Darwin and his followers, between species and varieties: breeding between species was impossible or produced sterile hybrids, whereas breeding between varieties was possible because they were all the same species and descended, relatively recently in evolutionary time, from common ancestors. Biologically, any claim to be ‘pure bred’ was ‘only comparatively true’, and meant a variety had been reared for a number of years or generations without a cross with any other variety.

Scientists and breeders were not always at odds. They were for instance fascinated alike by ‘antecedent impressions’, or what would later be ‘telegony’.⁴³ In 1879, Hugh Dalziel observed in his book *British Dogs* that it is,

one of the most strange and remarkable facts, as it is one of the least understood in connection with breeding, that the union of a bitch for the first time with a dog by which she conceives frequently exerts an influence on subsequent litters.⁴⁴

A common metaphor was the womb was ‘stained’ and that the taint wore off with each pregnancy. The phenomenon had been widely discussed by scientists since the 1820s and the Earl of Morton’s report that one of his mares, having previously borne a foal from an experimental cross with a quagga – a type of zebra that became extinct in the 1880s – produced foals with ‘a striking resemblance to the quagga’, when subsequently mated with a black Arabian horse.⁴⁵ Telegony was also assumed to occur in humans.⁴⁶ Thus, a mother with a first-born illegitimate child would not have only suffered moral and social condemnation, but also would have had to endure a ‘biological punishment’, deterring any future husband as his children would ‘inherit’ the features of a likely disreputable man who had fathered the first child.⁴⁷ In Thomas Hardy’s *Tess of the D’Urbervilles* (1891), Angel Clare is mortified on his wedding night when he learns that his bride, Tess Durbyfield, had borne a child after being raped by his nemesis Alec d’Urberville.⁴⁸ He then dwells on the fact that his wife is tainted and any offspring from their union would in some way be marked by Alec.

Another form of the inheritance of acquired characteristics reported by breeders was maternal-mediated impressions during pregnancy. This might be features taken from ‘uterine brothers and sisters in the litter’, which was particularly troublesome if ‘the carelessness of servants’ had given bitches the ‘the slightest chance [to] steal away in search of a mate of her own selection’.⁴⁹ Breeders also held the view that physical and mental experiences during pregnancy, particularly traumas, would mark the foetus. Doctors held such views for humans and there was common folklore, which involved trying measures to counter the effect and repair the disability or mark.⁵⁰ Some authorities looked beyond trauma to the influence of her surroundings on a pregnant female, citing the perhaps extreme case of the ‘celebrated breeder of black polled cattle [who] had his premises and fences tarred, with the express object of assisting Nature in keeping the colour of his stock as deep as possible’.⁵¹ All this meant that breeders tried to ensure that their pregnant bitches were well fed and kept in quiet, comfortable surroundings.

Breeders continued to report instances of telegony in dogs and other species throughout the nineteenth century.⁵² Scientists and veterinarians were increasingly sceptical; indeed, the term itself was invented in the 1890s by August Weismann, a founder of modern genetics, only to dismiss it, observing that it ‘has never been known to occur’.⁵³ For biologists, the Penicuik Experiments, conducted by the Glasgow University biologist James Cossar Ewart in 1894–95, conclusively disproved any effects from previous matings on any progeny.⁵⁴ Ewart’s twin aims had been to test the notion of telegony and to produce a horse–zebra hybrid suitable for draught work in South Africa.

There is a link between the work of Robert Bakewell and the development of genetics, albeit indirect. Wood and Orel have shown that Bakewell's ideas were taken up in Brno in Moravia and applied to establish Merino sheep in the region.⁵⁵ The local community of farmers and scientists, the most influential being Ferdinand Geisslern, investigated how traits, sometimes very distinct, were passed on from parents and sometimes grandparents, and developed what they termed 'genetic laws' to capture patterns.⁵⁶ They worked on both animals and plants, and especially with the latter studied hybrids. Their work was part of a much wider interest amongst scientists in Central Europe in inheritance, which had links with plant and animal breeders. What was the connection to Mendel? The head of the monastery that Mendel joined in 1843 was Abbot Cyrill F. Napp, a member of this community, whose major interest was – 'What is inherited and why?'⁵⁷

Breed

As we have seen, the term breed was first used for purebred livestock and commercial poultry, then sporting and fancy animals and finally with companion animals. Breed was a category for differentiating animals that was typical of a wider eighteenth-century project of classification and invention of taxonomies, which, for example, saw humans divided into races, tribes, classes, peoples, etc.⁵⁸ However, the context of its invention and association with domesticated animals in farming, transport, sport, fancy and companionship gave it particular uses and meanings. Breed signalled that the bodies and characters of domestic animals were remade by breeders in four ways:

- (i) Breeds were defined by, and bred to, a physical or conformation standard, with this defined by subdividing their body into points (Figure 17.1).
- (ii) Within a breed population, there was a drive to achieve greater uniformity of conformation and the previous normal distribution of size, colour, etc. diminished, or all but disappeared.
- (iii) Breeds were made more distinct from each other, with a tendency to develop exaggerated points to demarcate the differences between breeds. Previously the physical forms of domesticated animals had existed on a continuum; with breeds they became segmented with gaps between, sometimes occupied by inferior cross-breeds or mongrels.
- (iv) The goal of having a standardised, uniform population co-existed with that of improving and hence changing its form to better meet economic demands or the ideals of fancy breeders.

An example of the difficulties involved comes from the fact that historians of livestock have struggled with the origins of the history of types of cattle and sheep. In part, this is because of the dearth of written sources and the ambiguities of pictorial representations were coloured, metaphorically and literally by contemporary conventions of representation and technologies of reproduction. However, it is also because many historians have inappropriately used the Bakewellian notion of breed for earlier centuries. Nicholas Russell, in his book *Like Engend'ring Like*, records

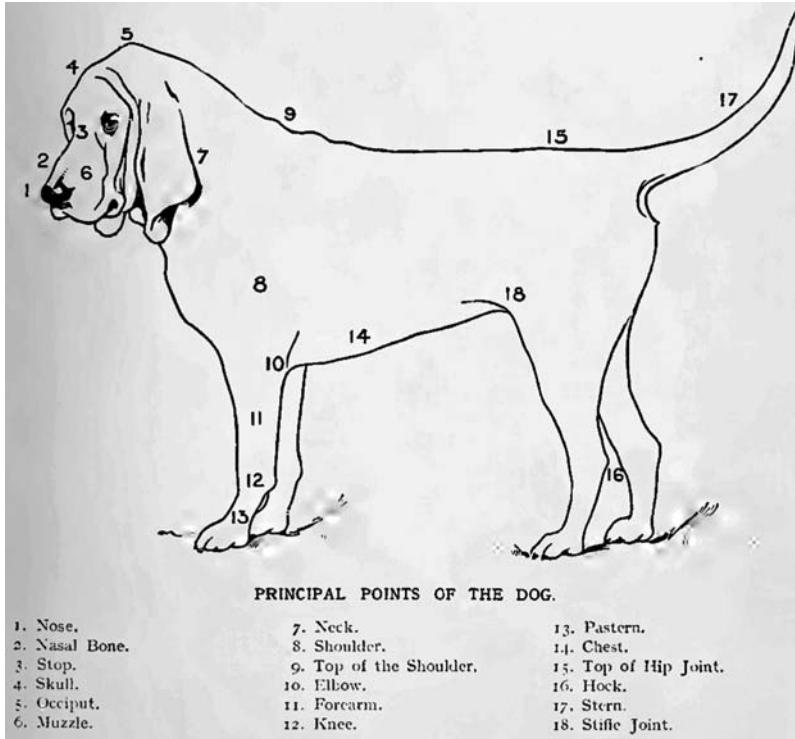


Figure 17.1 Principal points of the dog.

Collection of Michael Worboys.

how with most named types, there was variation in colour and markings, while size and shape were widespread with little uniformity. In describing sheep types in the eighteenth century, he muses that:

It may be that the concept of “breed” in the twentieth-century sense of a group of domestic animals sharing a large number of common morphological features by virtue of genetic homogeneity, is wholly inapplicable to the regional forms outlined here.⁵⁹

He goes on to observe, citing a survey of European primitive breeds, that,

Even when modern relict breeds under primitive management remain isolated, the management and selection pressures working on them seem to favour the survival of diverse morphologies rather than tending towards similarity of appearance.⁶⁰

For the late seventeenth century, Russell offers a classification of sheep in seven groups, defined by size, face colour, horns and fleece type, which he links loosely to regions and topography, but concludes that from the mid-eighteenth century

this was ‘dramatically altered’ by the spread of Bakewell’s New Leicester, and counterparts such as the Southdown, developed by farmers in Sussex.⁶¹

Sheep

However, Bakewell remains important for us as the inventor of the modern notion of breed, which John R. Walton has characterised as ‘an ingenious marketing and publicity mechanism’.⁶² Walton spells out how this worked for breeders:

Certain identifiable physical characteristics were imprinted in animals of a particular strain, and prospective purchasers were then encouraged to associate those markers with some attribute or attributes of productivity which, it was claimed, such animals also possessed: rapid weight gain, larger size, high food conversion rates, better distribution of meat, heavier milk yields and so on. The success of a breed depended to some extent on the visual impact of the chosen marker or trademark, and the ease of its transmission from one generation to the next, to some extent on the degree to which the claims made for the breed’s performance were thought to be valid.⁶³

In other words, breeds were ‘brands’. Bakewell’s New Leicester was claimed to be a better value product, where its name and design differentiated it from its competitors. Brands were also a form of intellectual property and something more. Those who acquired or bred from the New Leicester were buying into good blood and associating with an improving ideology. Ritvo makes a similar point with regard to the prize bulls, which represented for aristocratic elites their contribution to improving farming and a metaphor for their elite position based on genealogy and visible power.⁶⁴ Distinctive physical features also were important in differentiating between breeds and were made into signs of value.

Bakewell kept his best ewes and hired out his rams, thereby controlling his material and intellectual property. This practice had a triple benefit: protection of the breed; income from fees for service; and feedback, as he insisted on inspecting the offspring of his stud animals to test their potency. The latter became known as progeny testing.⁶⁵

Horses and cattle

The designation of types of working horses into breeds occurred at the same time as livestock, but in two contexts – farming and horse racing. Robert Bakewell developed his own new eponymous horse – the Bakewell Black, retrospectively seen as an early Shire horse.⁶⁶ Horses were mostly bred and classified by the work they undertook, hence, as well as for farm work certain types were bred for hunting, the army and transportation. The nearest to a breed in the eighteenth century was the thoroughbred racehorse, which was defined, not by conformation, but by lineage.⁶⁷ Racehorses in England had been improved in the late seventeenth and early eighteenth centuries by the importation of stallions from Arabia. The aim of breeders was to combine the lightness and speed of the Arabian, plus their assumed propensity to pass on these characteristics, with the strength of English mares, to produce a

horse that was fast and had stamina. Three stallions, imported into England from the Middle East in the late seventeenth and eighteenth centuries, still remain foundational in racehorse breeding. They were the Byerley Turk, acquired by Captain Robert Byerley as his war horse in the 1680s before becoming a stud stallion; the Godolphin Arabian, foaled in Yemen and imported to England in 1729 by Edward Coke; and the Darley Arabian, bought in Aleppo in 1704 by Thomas Darley.⁶⁸ Recent studies of the genomes of thoroughbred racehorses have revealed that 95% of the quarter of a million stallions worldwide can be traced back to the Darley Arabian and ‘ten founder females account for 72% of maternal lineages’.⁶⁹ The ‘thorough’ in thoroughbred meant, and still means, that a horse’s inheritance is confined to bloodlines from limited, foundation stallions and to a lesser extent mares. This restriction was formalised in 1913 when entry was limited to the progeny of horses already accepted in earlier volumes.⁷⁰

The belief that horses with Arabian or Turk heredity had superior powers of speed and that these were passed on to their progeny, meant that their descendants were sought after as stud animals. It was not lineage alone that counted; this was cross-referenced and combined with performance testing, both in races and at stud with their progeny. The importance of lineage was institutionalised in 1793 with the publication of the first volume of the General Stud Book, which was a public registry of the pedigrees of best thoroughbreds, while also serving as a resource for validating claims made by breeders about the identity of an individual horse.⁷¹ Previously, stud books had been kept privately and the contemporary assumption was that openness would deter fraud. There was a default conformation standard for thoroughbreds which was set by them all being bred for the same purpose in the same conditions – turf racing. In addition, there was a high degree of close breeding that necessarily followed from the limited number of bloodlines. The designation and development of the horse breeds in general was not made until the second half of the nineteenth century. For example, the English Cart Horse Society was founded in 1876, around the same time as those for Clydesdale, Suffolk Punch and the Shire were established.⁷²

Cattle breeders did not adopt formal registration and public stud books until the mid-nineteenth century, which signalled attempts to better standardise the animals they produced and to have their features recognised as breeds.⁷³ The Royal Jersey Agricultural and Horticultural Society, established in 1833, forbade the importation of cattle from France, allowing only improvement with cattle from England. The following year scales of points were agreed for bulls, heifers and calves, on the assumption that competitions for show prizes would improve the breed. A Herd Book recording pedigrees was only started in 1878, and then by the English Jersey Cattle Society, which along with conformation competitions organised butter testing.⁷⁴ The first Herd Book placed a significant emphasis on the importance of breed standards:

The history of the Jersey cow points a moral which cannot be overlooked, “Beauty and utility should be combined”. Although always noted for her dairy properties, it was not until the show ring points (which were indicative of good dairy cattle) were drawn up, and some approach to uniformity of

aim arrived at among breeders, that the increased demand arose for Jerseys from other countries, with a consequent increase in their value.⁷⁵

In fact, the first Herd Book for cattle was for Herefords, published in 1846, though a society to promote the breed was not formed until 1878.⁷⁶ In 1886 the Book was 'closed', that is, only calves born to sires and dams previously entered in the book would be accepted as true Herefords. This textual practice was designed to ensure the purity of the breed and also meant a degree of inbreeding. The Aberdeen Angus First Herd Book was established in 1862 and the Aberdeen Angus Society in 1879.⁷⁷

Poultry

The next domesticated species to be cast as breeds were poultry and pigeons. New types of poultry were created and imported to meet the economic demands of eggs and meat production and the aesthetic tastes of the fancy breeder.⁷⁸ The most popular imports were the Spanish, Cochin (China), Hamburg, Poland and Malay, and the most developed native type was the Dorking. Sir John Saunders Sebright, who was a politician and animal breeder, popularised the ideas of Robert Bakewell and produced small chickens, known as bantams.⁷⁹ He established the Sebright Bantam Club in 1810 to promote his creations, on the model of the Dishley Society, which met first in public houses and was associated with the working-class bird fancy and then to Gray's Inn Coffee House in London (Figure 17.2).⁸⁰

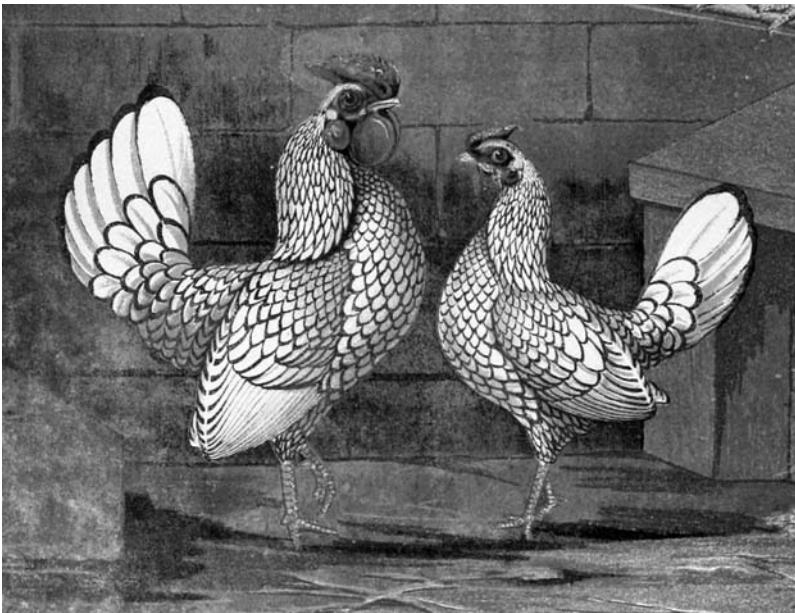


Figure 17.2 Fancy poultry.
Collection of Michael Worboys.

Poultry owning, breeding and showing had been popular across social classes since the late eighteenth century, but took off in the ‘hen fever’ that gripped Europe and North America in the mid-nineteenth century. Consequently, there was an increase in the number and size of poultry shows and the proliferation of fancy breeds. At the Manchester Poultry Show in January 1855, the judges were instructed not to reward size and weight, but to look for ‘high condition, beauty of plumage and purity of race’.⁸¹ The tension between breeding for utility and fancy came into the open in 1885, when the leading surgeon and specialist in urology Henry Thompson, announced that he had sold his large poultry collection because his high-bred birds laid poor quality eggs.⁸² He complained that the British bred for ‘feather’, while in France poultry was bred for meat and eggs, calling for ‘the prize feather system to be swept away’.⁸³ He was soon joined by Tegetmeier, who wrote ‘I do not hesitate to affirm . . . that no breed of fowls has been taken in hand by the fancier that has not seriously depreciated as a useful variety of poultry’.⁸⁴ In their defence, breeders argued that fancy points were a marker of pure breeding and that features such as heavy plumage had originally been linked to utility, in this particular case providing protection from the winter weather to ensure all-year-round laying. Tegetmeier’s critique, which was seen as perverse as he had been the nation’s principal show judge for half-a-century, was turned to advantage by breeders. They conceded some of the points on specific breeds, but generally argued that Tegetmeier was out of date: breeds had been improved and fancy points were being revised.

Many varieties of fancy pigeon had been bred for centuries, but in the eighteenth century breeding and exhibiting was institutionalised in clubs and societies.⁸⁵ Over many centuries and across the world, many and remarkably different physical forms of the rock dove (*Columbia livia*) had been produced and at shows birds were judged on their form, colour and beauty. In his *The Complete Pigeon Fancier*, published in 1790, Daniel Girton gave descriptions of 28 ‘species’: Pouters, Carriers, Horsemen, Dragoons, Croppers, Powting-Horsemen, Uplopers, Fantails, Chinese Pigeon, Lace ditto, Tumblers, Runts, Spots, Laughters, Trumpeters, Jacobines, Capuchins, Nuns, Shakers, Helmets, Ruffs, Finnikins, Turners Barbs, Mahomets, Turbits, Owls, Smitters and others.⁸⁶ In nineteenth-century England, exhibitions were regulated by two societies, the National Columbarian Society and the Philoperisteron Society. The latter pioneered a numerical system for judging birds, where the different points were weighted and scored, with the cumulative score settling which was the best bird.⁸⁷ This Gradgrindian attempt to objectify the definition and appreciation of breed did not catch on; nonetheless, it demonstrates how fine-grained the differentiation of breeds had become by the mid-nineteenth century.

Dogs

Martin Wallen has argued that ‘the foxhound was the first modern dog to be recognized as a breed’, pointing to the breeding practices of Robert Bakewell’s neighbour Hugo Meynell, who developed hounds that had ‘fine noses’ and were ‘stout runners’.⁸⁸ However, Wallen goes on to argue that:

Meynell and the others did not set out to create a 'breed', they plainly intended to create an improved hound that would serve a single purpose they valued within the institutional framework that cast animals as resources. Instead of adapting their activities to available hounds, they created a distinctly modern hound that facilitated their sport.⁸⁹

In practice this meant foxhounds were bred to suit local geographies and it was not until the spread of the railway from the mid-nineteenth century, which allowed the easier movement of hounds for breeding and sport, that a singular breed was established. The development of dog shows from the 1860s was decisive in this process, encouraging breeding to ideals, which led to the creation of a more standardised and uniform foxhound population across the country.

The impact of dog shows and the drive for standardisation is well illustrated by the physical and cultural remodelling of the bulldog. In 1874 a group of men met in the Blue Post, a pub just off Oxford Street in London, to found the Bulldog Club. A club of the same name had been formed in 1864, but only lasted three years. The new initiative was prompted by concerns that certain dog breeders were trying to make the English bulldog larger, by cross-breeding with the Spanish bulldog, thus, the purity and very Englishness of the national dog was under threat.

However, their aim was not actually one of preservation, as there was no agreement on the ideal type due to the fact that many different types of dog had been used in bull baiting. Indeed, the types mostly spoken and written about had been in terms of character and ability – courage, boldness, resolution, pluck, tenacity – and only secondarily in relation to physical form. William Youatt in his book on *The Dog* in 1845, placed the bulldog at the head of an 'inferior and brutal division', which though it had a characteristic 'thick head, turned-up nose, and thick pendulous lips' was principally portrayed in terms of 'ferocity', 'fury' and 'obstinacy'. In his influential book *The Dog in Health and Disease* published in 1859, John Henry Walsh began his account of the bulldog by quoting Cuvier on the size of its brain and lack of 'sagacity', and then emphasised 'two remarkable features': 'firstly, they always make their attack on the head; and, secondly, they do not bite and let go their hold, retain it in the most tenacious manner'.⁹⁰ The illustrations that accompanied Youatt's and Walsh's descriptions (Figures 17.3 and 17.4) show a dog with a short snout, but not the flat face and without the protruding lower jaw that later Victorians emphasised. The characteristic legs and stance are evident, however, but this may have been selected for the tavern-based dog fancy of ratting and showing that developed after the banning of bear-baiting.

By 1875 when the new Bulldog Club set its standards, the development of dog shows and breeders, exhibitors, judges and commercial interests that supported it had defined dog breeds almost exclusively in terms of their physical form – size, colour, shape, coat, bodily proportions, etc. The new bulldog standard was typical in delineating 17 physical points against which individual dogs could be scored by judges in dog shows. The Bulldog Club also began a Stud Book, which recorded detailed measurements of the features of every dog along with its pedigrees back to its great,

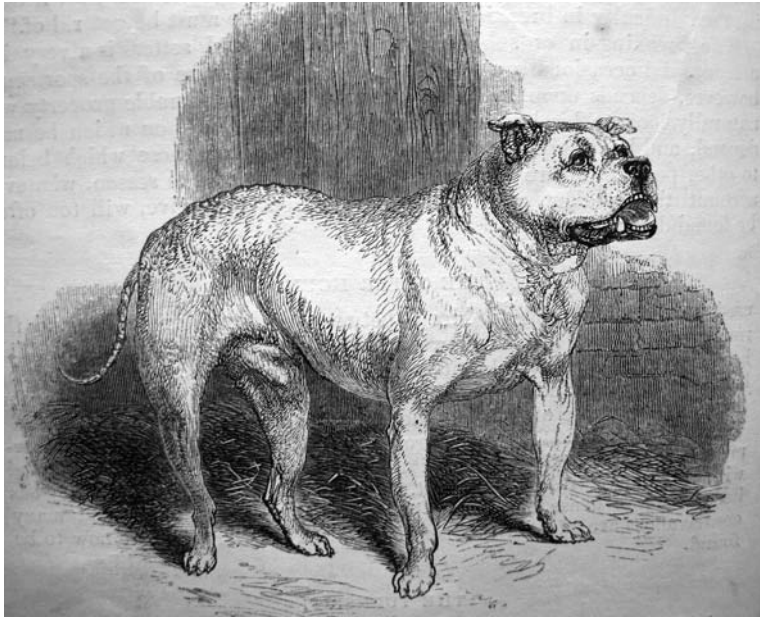


Figure 17.3 ‘The bull-dog’. From W.Youatt, *The Dog*, London: Society for the Diffusion of Useful Knowledge, 1845, 151.

Collection of Michael Worboys.



“Top,”* a pure Bulldog, the property of C. Stockdale, Esq., Shepherd’s Bush.

Figure 17.4 “‘Top”, a pure bulldog’. From Stonehenge [John Henry Walsh], *The Dog*, third edition, London: Longmans, Green, 1879.

Collection of Michael Worboys.

great grand sires and dams. Pedigrees were used to show that ancestors had been from 'good stock' and usually prizewinners, which meant closely or inbred, or what was termed 'pure bred'. Both the points and the stud book were controversial. Some, mostly older, fanciers warned against 'fixed types' and judging animals by their lineage; they argued that market demand was for dogs of character and ability, not fancy dogs of the same standardised conformation, from the same stock. The aficionados of the Club maintained that conformation was a reliable indicator of character and ability, and needed to be preserved by close breeding. There were also quarrels within the Club about who should judge at dog shows and whether it was best to decide the top dog on points alone, or to consider the overall 'look' and movement of the animal. Personal rivalries and economic interests in new social networks and institutions of a dog fancy fed such disputes, reformed from its early nineteenth-century association with blood sports and crime.

The standard points agreed by the Club were apportioned numerical scores, where 'perfection' would achieve 100 marks, distributed thus: 10 to 'general appearance', 15 to the skull and 5 each to another fifteen points.⁹¹ In this process, and building on changes wrought through dog shows, the bulldog had been remodelled, most noticeably with a new head that had features imagined to have been essential to hang onto a bull's head. The most important were drooping jowls (dewlaps) and a protruding lower jaw, to grip the bull's soft under-chin, and a flat face, to allow breathing during the physical exertion of holding on (Figure 17.5).

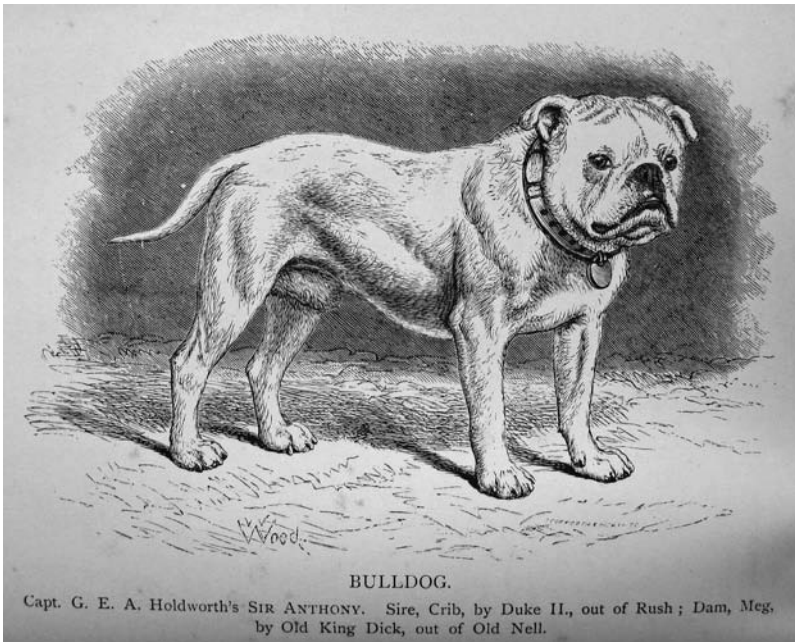


Figure 17.5 Captain Holdsworth's Sir Anthony, bulldog.

Collection of Michael Worboys.

The aim of producing a larger dog was also predicated on assumptions about the weight that could wear down a bull, but it was not just physique, the standard also called for dogs that convey 'an impression of determination, strength and activity, similar to that suggested by the appearance of a thickset Ayrshire or Highland bull'.⁹² The fate of the bulldog typified what happened to all types of dog and saw the creation of new standards based on conformation rather than actual utility.

By the end of the nineteenth century the word breed was used for the different forms of livestock and domesticated animals. Its adoption in the nineteenth century and extension into the twentieth was more than a matter of words. Its usage signalled major changes in the physical form of individual animals and populations, as those categorised as breeds became more uniform in look and had less genetic variation. The preferred physical form of each breed had been and continued to be a subject for negotiation, but the agreed forms objectified and reified breed standards to such an extent that they appeared 'natural'. Within communities of breeders and more widely across cultures, breeds were essentialised, an important part of which was an imagined, presentist history where it, or some primitive form of it, had existed for centuries, if not longer. For example, one line of descent claimed for the English Mastiff was from the bitch of Sir Piers Legh, which accompanied him to the Battle of Agincourt in 1415.⁹³ Legh was wounded and was guarded by his faithful bitch, but he eventually died. His body was returned, accompanied by his bitch, to be buried at the family estate at Lyme Hall in Cheshire. The bitch became the foundation 'blood' of what became known as Lyme Hall Mastiffs and it was claimed that the family maintained its bloodline through to the nineteenth century when formal standards for the breed were proposed. Few nineteenth-century fanciers accepted the story and, playing with aristocrat stereotypes, suggested that there must have been below-stairs matings and, if the Legh story were accepted, then there would have been inbreeding and degeneration.

The pedigree breeds of dog proliferated in the latter half of the nineteenth century, with many types of dog reinvented and newly produced as 'breeds'. Some dogs, notably the Irish Wolfhound, were seemingly manufactured, the term contemporaries used, entirely from cross-breeding different kinds of dog. The emergence in the latter half of the nineteenth century of the dog show as an event distinct from agricultural shows and that measured and promoted particular 'standards' of dog breeds is testimony to public interest and investment in the notion of 'breed'. Before 'breed' there had been a range of size, shapes and colour within a variety, and there were no well-defined boundaries between varieties; they shaded into one another at the margin. After *breed*, each breed was a distinctive, ideal type that conformed to a standard, and there was uniformity within the breed population. Thus, marginal forms disappeared and their place was occupied by cross-breeds, which have become very popular in the twenty-first century. The very name – cross-breed, which has displaced mongrel, confirms the dominance of breed in modern thinking about dogs. This can be seen in recent surveys, which showed that, in 2013: 64% of British dog owners reported that their dog was a pedigree breed; 31% a cross-breed; 2% designer cross-breed and 3% 'not sure'.⁹⁴ The category 'No breed' was not an option.

Conclusion

Animal breeding in the twentieth and early twenty-first centuries showed continuities and discontinuities with early times. The tension between ‘art’ and ‘science’ persisted, but Derry has shown that this varied between different species and contexts, and over time, and was often more rhetorical than real.⁹⁵ Breeding ‘science’ was dramatically changed by the development of genetics, principally based on Mendelian principles, but its impact was uneven, due, as noted already, both to the complexity of animal inheritance and to the different cultures and goals of breeders. This conclusion has been endorsed by Bert Theunissen’s work on animal breeding in the Netherlands.⁹⁶ Nevertheless, the alternative model supported by biometricians retained some influence in population genetics. Geneticists in this specialism charted statistical variations in different crossings, and became important from the mid-century with the advent of factory farming and the freezing of semen, allowing the global dissemination of an individual’s heredity. Arguably, the most radical change in the twentieth century was the industrialising of breeding, for example in the mass production of chickens for egg-laying and rearing for meat. In both industries, where special breed companies and agencies were created, artificial insemination was used to spread the influence, qualitatively and quantitatively, of ‘genetically superior cockerels’.⁹⁷ The superiority of both cockerels and brood hens has been measured by ever more sophisticated forms of ‘progeny testing’, which determines market prices and the subsequent selection of breed stock. In these circumstances, the breeder and rearer of the chicks are different people and may never meet.⁹⁸ The opposite remains the case with cattle and sheep, where typically breeders who are also farmers select sires and mothers, on both their physical form and their pedigree. Sheep breeding also continues to be practised on the farm, though the possibility of the end of breeding was signalled in 1996, with the cloning of Dolly.⁹⁹

By the end of the nineteenth century most domesticated animals had been differentiated physically and culturally into breeds, and in the twentieth century became ever more opaque as species. Wild animal species are recognisable because individuals look alike: for example, urban foxes are all of a similar size, colour and shape. Dogs, however, which are similarly sized and distantly related, have been bred in all sizes, colours and shapes. We can only speculate what size, colour and shape *Canis lupus familiaris* was before it was subject to ‘artificial selection’, or what it might become if no longer bred selectively. Humans have wrought the greatest differences in size and shape with dogs, but the horses, cows, sheep and many species of birds have been similarly remade. We now only know these species as divided into breeds, a category that has been essentialised and naturalised.

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