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Turning Herbage into Money:¹

The Economic Inducement and Scientific Legacy of 18th and 19th Century Livestock Improvement in England

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The economic motivations of modern factory farmers, raising hefty and often unhealthy animals to meet popular demand, parallel those of English livestock breeders in the 18th and 19th centuries, particularly Robert Bakewell of Dishley (1725-1795). Bakewell revolutionized livestock husbandry by popularizing selective inbreeding in order to satisfy growing economic demands, contributing to the organization of local livestock societies as seen in various letters of correspondence. Previous breeders were mostly unsuccessful in isolating preferred characteristics due to their use of crossing techniques that inevitably diversified their stock. In contrast, Bakewell's improved animals were bred to mature faster and consume less, predecessors to breeds consumed today. Unlike modern breeders, Bakewell invested in livestock before genetic inheritance was scientifically understood, so that his methods were based on experience alone. His techniques gained notoriety nonetheless, inspiring Central European breeders to increase the accuracy of their work, spurring an inquiry into inheritance. Economic growth and subsequent animal product demand in 18th and 19th century England incentivized Robert Bakewell’s improved livestock husbandry techniques and permanently altered the English livestock industry in the creation and methodology of breeding societies. The efficiency and lucrativenss of selective breeding stimulated an interest in understanding heredity which directly influenced sheep breeding organizations in Central Europe, accumulating a body of knowledge that contributed to the context of Gregor Mendel and Charles Darwin’s discoveries.

Before Bakewell, heredity was perceived as an ambiguous force. European natural philosophers recognized the key pattern— that like characteristics breed like characteristics— as

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3 See Appendix A, Figure 1.
early as the 16th century, but selective breeding was essentially nonexistent until the next
century.\textsuperscript{4} Even as 17th century breeders developed an interest in exploiting this observation, their
"knowledge that like bred like was partial and entirely heuristic: they were concerned with what
worked, not why."\textsuperscript{5} This focus on the practical application of breeding methods over any
scientific inquiry into heredity defined livestock husbandry for generations. Asking 'why' had no
incentive, but exploring 'how' had economic potential. Before farmers experimented with
controlling livestock's characteristics through breeding, they took note of the environment's
affect on their stock, especially when it came to Spanish Merino sheep.

Wool from Merino sheep was excessively lucrative and had been a major source of
wealth in Spain since the 15th century. In addition to royal edicts, Spain maintained its wool
monopoly thanks to perceived laws of nature.\textsuperscript{6} Common knowledge dictated that Merino sheep
thrived only in Spain and that removing them to any other environment led to degeneration and
poorer wool quality. Without any scientific evidence to validate this theory, it was instead
“supported by common sense and experience, and sanctioned by religious belief in divine
design.”\textsuperscript{7} Empirical observation endured as the main authority in livestock breeding even as
importers began to question the extent to which Merinos were tied to their land. Importers were
faced with a daunting task: circumventing the laws of nature to maintain the quality of their
sheep. Continuous importation to “refresh” one’s stock proved expensive, but the ability to

\textsuperscript{5} Cobb, "Heredity Before Genetics," 956.
\textsuperscript{6} Richard Bellon, "Reviewed Work: Genetic Prehistory in Selective Breeding: A Prelude to Mendel by Roger Wood,
\textsuperscript{7} Ibid, 403.
improve Merinos through selective breeding, thereby preventing their typical deterioration, provided an opportunity for wealth.⁸

Breeders outside of Spain attempted to improve their Merino stock through an early selective breeding method known as ‘crossing.’⁹ These breeders referred to animals' “blood” as their source of heritable biological characteristics¹⁰ so that breeding literally implied “crossing with other blood.”¹¹ They bred Spanish sheep with local breeds and, without a modern understanding of heredity, attempted to mitigate sheep degradation. This practice was unorganized, resulting in biological variation and yielding equally erratic economic results.¹² The uncertainty was partially due to the fact that livestock was not contained in enclosures. There was typically a “village herd” that wandered about, making it difficult to control the mating of individual animals.¹³ The British enclosure movement, which gradually imposed property boundaries in England and beyond, gave English breeders more control over their stock and contributed to breeders' transition away from crossing and towards more precise selective breeding methods.

The enclosure movement and shift to grassland farming in Robert Bakewell’s home of Leicestershire provided the tools for livestock experimentation. By the early 17th century, over

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⁹ Jonas Alströmer (1685-1751) was one of the first to import Merinos and successfully improve them in an environment outside of Spain, specifically Sweden. Bellon, "Reviewed Work: Genetic Prehistory," 403.

¹⁰ Cobb, "Heredity Before Genetics," 956.


¹² Ibid.

half of Leicestershire was at least partially enclosed, presenting the opportunity for controlled breeding. Bakewell's pasture-floating irrigation system at Dishley allowed him to graze more livestock during the "critical period" in early spring, immediately distinguishing him in the livestock industry. Despite the developing European interest in selective breeding as opposed to crossing, English breeders like Bakewell did not invest in livestock improvement until a greater economic incentive developed. England continued to import foreign wool, primarily from Spain and later from Central Europe, and therefore the domestic wool industry in England was not particularly lucrative. A spike in demand for mutton and beef in rising English industrial cities changed the use of sheep and cows from wool and milk to meat, establishing a profitable market for fast growing, big-bodied livestock that crossing alone could not produce.

The growth of England’s cities corresponded to a robust demand for mutton and beef that Robert Bakewell sought to meet through his use of 'in-and-in breeding.' The demand specifically came from “the hungry poor of the new factory cities,” working class people with a need for affordable sources of protein. Bakewell aimed to sculpt new and improved breeds ideal for meat production, applying a methodology that was vaguely scientific in its scrupulousness. He carefully chose both mates and boldly inbred animals to amplify certain characteristics, which proved revolutionary due to the quick results. His meticulous method involved searching for perfect specimens to breed, deemed perfect if they met "four criteria: 'beauty,' the proportion of

15 Ibid, 40.
18 Wykes, "Robert Bakewell," 44.
edible to non-edible parts, meat quality and growth rate." The goal was to produce livestock with consistent, uniform traits rather than the occasional superior animal. Although he did not invent inbreeding for livestock improvement, Bakewell popularized this method with the breeds that he created. Bakewell's legendary New Leicester sheep and Longhorn cattle became world-renowned precisely because they produced meat more efficiently than nearly all other livestock at the time. Despite his impressive innovations, Bakewell was ignorant to the scientific implications of his work. Instead, Bakewell was interested in his livestock's profitability.

Bakewell was chiefly concerned with and motivated by the economic potential of his improved livestock, setting high prices for 'letting' his rams and cows. He once dubbed his New Leicester sheep breed, "...a machine for turning herbage... into money." To Bakewell, the purpose of livestock breeding was making a profit. This money came from selling his livestock as well as leasing out individuals to be bred, a practice known as 'letting.' Again, Bakewell did not invent this practice, but he did popularize letting tups (rams). Letting resulted in the elevated role of "specialist breeders or tupmen" and allowed more breeders to retain ownership of their best animals while continuing experiments in improvement. In his comprehensive

19 Cobb, "Heredity Before Genetics," 956.
20 The exact origin of this inbreeding technique is unclear, possibly associated with early horse or dog breeding in England. Wykes, "Robert Bakewell," 44.
21 See Appendix A, Figure 2.
22 See Appendix A, Figure 3.
24 Wood and Orel, Genetic Prehistory, quoted in Cobb, "Heredity Before Genetics," 956.
25 Before Bakewell, letting was common with stallions, particularly in Lincolnshire. Wykes, "Robert Bakewell," 45.
26 Ibid.
publication on Bakewell, David L. Wykes writes that Bakewell's most controversial prices were set in 1786, when he made up to £1000 for letting merely 20 rams. This unusual price contrasts those prior to 1780, most of which were under 10 Guineas per animal. He no longer bothered to fix prices after 1788, choosing from bids between his customers. Although these prices caused controversy among his contemporaries, Bakewell argued that, "if the price is low, people send any kind of cows, and if the product fails, the bull is blamed; but if the price is high, they are particular, and send none but the very best, which is the only method to improve the breed." Bakewell was determined to control, or at least heavily influence, the progression of livestock experimentation, aiming to establish improved and consequently more lucrative breeds. His methods became widespread.

Bakewell's achievements led to the dissemination of his organizational tactics and normalization of livestock judging, which became central practices of emerging agricultural societies. Bakewell thrived in creating new livestock breeds thanks to his scrupulous approach to livestock improvement. Always more interested in economic potential than the science behind his experimentation, he depended on "painstaking record-keeping and farmer's literally hands-on skill of judging stock; theoretical explanations could wait." As Bakewell's methods became the "breeding norms," the purpose of judging stock shifted from a diligent measure of livestock improvement to a new economic opportunity, since winning meant more prestige for the breeder.

28 Ibid, 46.
29 Ibid.
and their animals. Bakewell’s widespread tactics helped to standardize the methodology of the Leicestershire livestock breeding community, leading to the creation of livestock breeding societies. These associations, particularly that managed by Bakewell's friend and colleague George Culley, actively sought Bakewell’s input.

As an agricultural authority highly respected by local breeding groups, Bakewell directly impacted the livestock industry in Leicestershire. In a series of letters from Culley to Bakewell in 1792, published by H. Cecil Pawson in 1959, Culley often implored Bakewell to attend meetings or approve decisions of the newly formed "Association on the Tup Business" in Leicestershire. In pursuit of further order, or perhaps exclusivity, Culley proposed to establish a boundary of sheep breeding in respect to other breeding societies, asking Bakewell's concurrence. The next letter revealed that Bakewell did not agree to Culley's placement of the line, an opinion to which Culley deferred and attempted to negotiate: "Am I desired to say that we will give up Lancashire, Westmoreland, Cumberland & the West riding or Yorkshire provided you will allow us the East & North ridings, with Durham this County & Scotland." These letters do not provide an accurate record of Culley’s true motivations, but Culley's willingness to work around Bakewell's preferences seems to demonstrate the breeding society's esteem for Bakewell, even in disagreement. Bakewell's opinions were not the only obstacle to Culley's plans. General suspicion and downright opposition to the somewhat secretive and exclusive breeding associations grew in Leicestershire until some demanded that they be dissolved.

31 Schinto, "Good Breeding," 32.


33 Ibid, 9-12.
societies persisted nevertheless, spreading Bakewell's techniques further. Bakewell's economic success and fame established him as a key figure in the tense politics of emerging breeding associations, extending his influence from the breeding business of Leicestershire to society's perception of livestock at large.

The bulbous animals that Bakewell produced, and their huge economic potential, won Bakewell international fame and influenced society to value livestock for the main characteristic that Bakewell bred for: fatness. News about Bakewell’s new breeds spread quickly and visitors frequently visited his estate: “Farmers from France, Germany, Russia and Austria all sought to copy his techniques.”34 This trend popularized livestock portraiture, which utilized the "iconography of horse portraiture" to make the depicted animals appear larger.35 36 Originating as a means of advertising and recording the dimensions of impressive livestock, especially champions of livestock judging competitions, portraits of large cows became status symbols in the 19th century and a fashionable trend thereafter, a key component of the persisting "fatness fad."37 38 Although the accuracy of these paintings is often questioned, they exemplify the idealization of huge animals.39 Bakewell’s legendary fat livestock influenced society’s perception of livestock as well as agricultural techniques throughout Europe.

34 Cobb, "Heredity Before Genetics," 956.
35 Schinto, "Good Breeding," 33.
36 See Appendix A, Figure 1.
37 Schinto, "Good Breeding," 34.
38 In the early 19th century, fat livestock became a staple of traveling shows, "bred as oddities... rather than as marketable meat." They gained popularity with the Victorians in the 1830s as well: "international royals often exchanged fattened animals as gifts." Ibid, 33.
39 See Appendix A, Figure 4.
A group of Central European sheep breeders centered in Brno advanced the selective breeding work of Bakewell in seeking to improve the wool quality of their stock, shifting the practice of livestock experimentation from a purely economic pursuit to a scientific discipline. Ferdinand Geisslern (1751-1824), dubbed “the Moravian Bakewell,” gained fame in selectively breeding Merino sheep to preserve and even improve their wool quality once imported from Spain. Geisslern replicated Bakewell's inbreeding methods to produce lucrative fleeces that could sell for between 39 to 650 florins per 100 head. Geisslern's work caught the attention of naturalist Carl Andre (1763-1831), who promoted the application of scientific techniques to enhance the industry and became a key influence on the Moravian Agricultural Society. His son, Rudolf Andre (1798-1827), wrote a textbook articulating Bakewell's in-and-in breeding tactics with more technical language. Isolating and defining observed laws of nature became a constant goal, and source of tension, for the members of the several Moravian agricultural societies. Hungarian sheep breeder Count Emerich Festetics (1764-1847) sought to defend his view that heredity and inheritance could be manipulated by human interference, especially inbreeding, by establishing four genetic laws based on his own observations in 1819, almost fifty years before Gregor Mendel (1822-1884) published his laws of inheritance. In an attempt to increase the accuracy of their sheep breeding techniques in order to benefit their wool quality and sales, these Central European breeders developed a scientific approach to their work.

Initially motivated by the economic potential of Bakewell's livestock improvement in England, breeders in Brno began to explore, articulate and define the biological context of selective breeding. This prompted an enduring dialogue surrounding heredity in Brno which impacted the discoveries of Mendel.

The experimentation of Bakewell and Central European breeders established the context for Mendel and Darwin’s discoveries. Cyrill Franz Napp (1792-1867), the abbot of the Augustinian monastery in Brno which Mendel would later join, was particularly interested in conversations on heredity, partly because the monastery benefitted monetarily from the sheep industry, as recorded by prominent researchers Roger J. Wood and Vítězslav Orel. Napp pushed Mendel to partake in university classes on the scientific implications of plant and livestock breeding taught at the Moravian University of Olomouc as soon as 1827. The city of Brno became a hotspot for discussions on heredity and inheritance, begging the question of "whether Gregor Mendel and the work that led him to his laws of heredity came from nowhere, or whether there was a long and rich tradition into which he was tapping." The implications of selective breeding methods that Bakewell popularized and that Central European breeders advanced permanently shifted from economically useful to scientifically revolutionary with Mendel's discovery of the laws of inheritance (published in 1865) and Darwin's theory of evolution (published in 1859). In On the Origin of Species, Darwin directly cites Bakewell's work with cattle and sheep in his chapter "Unconscious Selection." Darwin references Bakewell as an example of "breeders [that] could never have expected, or even wished, to produce the result

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44 Wood and Orel, "Scientific Breeding," 245.

which ensued—namely, the production of different strains."\textsuperscript{46} Darwin acknowledges that Bakewell's breeding success was inadvertent, simply a consequence of meticulous techniques based on trial-and-error, shaped by experience and without scientific forethought. Bakewell began improving livestock due to the economic prospects, but his legacy impacted the theories of two of the most famous scientific authorities. Despite Bakewell's considerable fame and influence, the validity of his personal economic and breeding success is worth questioning.

The inherent economic risks in livestock breeding and letting, combined with the method of inbreeding animals for fatness only, reveal that Bakewell's fame perhaps overstated his personal successes. Bakewell experienced bankruptcy in 1776, which remained unresolved until 1789, forced to auction off some of his stock.\textsuperscript{47} Despite his high letting prices, Bakewell's financial troubles exposed the uncertainty of the livestock business. Bakewell was also known for his hospitality and generosity—allowing visitors to stay without charge and letting animals to debtors,\textsuperscript{48} so it seems that Bakewell’s own choices may also be blamed here. Even his famous breeds had obvious deficiencies. As a result of selectively inbreeding for specimens that grow quickly and produce more meat, the New Leicester sheep lost wool quality and Longhorn cattle lost milk quality.\textsuperscript{49} The English Longhorn is rare today.\textsuperscript{50} The New Leicester sheep, on the other hand, has endured in modern crosses due to its exemplification of quick maturity and high meat proportions. Bakewell’s contemporaries criticized both breeds for the poor quality of their meat,


\textsuperscript{47} Wykes, "Robert Bakewell," 47.

\textsuperscript{48} Ibid.

\textsuperscript{49} Ibid, 49.

\textsuperscript{50} The Short Horn cattle breed replaced the Longhorn in popularity due to its superior health and milk production. Ibid, 49. See Appendix A, Figure 4.
which contained high amounts of fat. Bakewell famously responded to such criticisms in that, "I do not breed mutton for gentlemen, but for the public." Bakewell was overall more concerned with the economic potential of his animals than their scientific implications or their actual quality. He was just meeting the demand of the poor working-class in growing cities. Bakewell's economic motivations were all-consuming to the extent that they justified improving livestock's profitable characteristics while others deteriorated. Even with these imperfections, Bakewell's reputation as one of the most influential European livestock breeders has lasted.

Bakewell's fame endures because he popularized selective livestock breeding for chiefly economic purposes, demonstrating that humans can actively improve their stock. He met the demand of growing industrial cities, dispelling the conviction that livestock was essentially tied to their environment of origin, previously exemplified by the degradation of Merino sheep outside of Spain. Central European sheep breeders in Brno, utilizing Bakewell's methods, sought to articulate the patterns of inheritance that they observed while breeding for wool quality. Successive discussions on the science behind heredity established the context to Mendel's inquiry into inheritance and Bakewell's prominence landed him several references in Darwin's *On the Origin of Species*. Bakewell's fame has left two distinct legacies: one in the scientific community's understanding of genetics and another in the purpose of modern factory farming. Bakewell created new livestock breeds which matured faster and produced more meat in order to satisfy a growing economic demand, just as overcrowded and unsanitary factory farms so often sacrifice animal health and meat quality to profit from mass consumption today, both in the U.K.

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51 Wykes, "Robert Bakewell," 50.
52 Ibid.
and U.S. The ethical implications of tampering with nature for human benefit is particularly striking when it comes to Bakewell's New Leicester and Longhorn breeds. Despite the scientific applications of his work, Bakewell seemed to have only one goal in mind: making a profit.

Appendix A

Figure 1

*Robert Bakewell Mounted on a Bay Cob*, Boultbee.
Estimated 18th century.\(^{55}\)

Figure 2

*The New Dishley Ram*, Phillips. 1807-8.\(^{54}\)

Figure 3

Estimated 18th century.\(^{57}\)

Figure 4

*Portrait of the Short Horned Bull Patriot*, Ward. 1810.\(^{56}\)

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Emerich Festetics' Genetic Laws (1819):

(a) Healthy and robust animals are able to propagate and pass on their specific characteristics.

(b) Traits of grandparents that are different from those of the immediate progeny may reappear in later generations.

(c) Animals possessing desirable traits that have been inherited over many generations can sometimes have offspring with divergent traits. Such progeny are variants or freaks of nature, and are unsuitable for further propagation if the aim is the heredity of specific traits.

(d) A precondition for successful application of inbreeding is scrupulous selection of stock animals.

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58 Poczai, Neil, and Hyvönen, "Imre Festetics."
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