

Turbo-Cows Producing a Competitive Animal in the Nineteenth and Early Twentieth Centuries

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According to available statistical data, the history of the modern cow is a story of ever-increasing amounts of milk produced by one animal. Whether one consults national or international, long- or short-term statistics—all of which correlate the number of cows with milk output in a region—the message remains the same: the yield per dairy farming cow has been increasing constantly since the second half of the nineteenth century. Over a period of about 150 years, milk production became one of the most efficient sectors of agribusiness, with statistics showing that this was due in large part to the seemingly unlimited capacity of the individual animal to increase productivity.

Estimates by nineteenth-century agronomists indicate that the milk production per cow in that period averaged not more than one-quarter of today's cows. In 1812 agronomist Albrecht Thaer noted that a cow "in a well organized farm" produced about four quarts (one quart = $1\frac{1}{7}$ litre) of milk a day. Within a lactation period of 280 days, he said, a yield of 2,560 pounds a year would be an excellent result.¹ In 1868 Georg von Viebahn, director of the Prussian-German Bureau of Statistics, reported that a poor quality cow would give at best 2,592 pounds per annum, whereas a high quality animal yielded about 3,456 pounds. Viebahn averaged the milk performance of the Prussian cow at 3,000 pounds, although he conceded significant problems with data acquisition.² In comparison, modern cows serve as perfect milk machines. While the numbers of dairy farmers and cows per farm are steadily decreasing, the average performance of a cow per annum is on the rise. In Switzerland, production per cow grew from 8,360 pounds in 1980 to 10,700 pounds in 1998. In Germany production rose from 11,150 pounds in 1997 to 11,500 pounds in 1998 and to 12,224 pounds in 2000.³ Apparently, increasing milk production per cow has not yet reached its limit.⁴

The intention of this essay is neither to confirm the statistical evidence for high-yielding milks cow nor to discuss whether we can "trust in numbers," Theodore Porter's concern.⁵ For the purpose of this essay, I will accept the remarkable statistical increase of milk production per cow as a matter of fact.

As a friend of mine, a dairy farmer, put it, today's farmers who are not able to produce more than six thousand litres of milk (or twelve thousand pounds) per cow are perceived as losers.

If one takes the statistical increase in milk yield per cow as given, then the framework for further study becomes apparent. Apart from the fact that collecting data about milk performance is itself part of the history of improving the cow's natural capacity to lactate, the thorny question of what these data mean also arises. Can we explain the phenomenal increase in milk production as a successful technical manipulation of the biological productivity of an animal's body? Or must the high-yielding cow be seen as part of a larger process of agro-industrialization that not only transformed the practices of animal husbandry in the nineteenth and twentieth centuries but also facilitated a profound restructuring of the relationship between man and animal, nature and technology?

Historians of agriculture argue that the tremendous success of milk production is evidence of the dissemination and application of scientific knowledge to farming practices. The most influential sciences in changing animal husbandry, we are told, have been animal nutrition research, on the one hand, and scientific breeding and population genetics, on the other.⁶ As if practical value and efficiency are inherent properties of scientific knowledge, statistical data on meat and milk production are read as a confirmation of scientific success. From the perspective of the practitioner, however, the transformation that resulted in the modern dairy farming system depended on much more than the application of clearly defined knowledge.⁷ In support of the practitioner's opinion, high-yield cows are not entirely a new phenomenon. As early as the nineteenth century, there were reports of milk performance that were nearly as high as that of today's cows. According to observations made by August Meitzen, a well-known economist and historian at Humboldt University in Berlin, even ordinary cows sometimes gave surprisingly high yields.⁸ At the same time, the above-mentioned director of the Prussian Bureau of Statistics, Viebahn, observed a quasi-natural rise of milk production in areas near big cities. Referring to von Thunen's "Isolated State" model from 1829,⁹ Viebahn suggested how trade between city and country influenced the efficiency of animal husbandry. Increasing milk production depended on how much people were willing to pay and on the cost of transporting milk products to urban markets, in his view.

As Viebahn noted, Prussian agriculture centered on grain production. Commercial dairy farming was found only in areas where intensive agriculture directly bordered on towns. In other cases, when dairy farming was not organized around market trade, output depended on the natural resources available for agriculture, in particular, on the relative amount of greenland in a region. Thus, Viebahn acknowledged the risk of misinterpreting average values. Data from various German states (in this period, Germany was a Conféd-

eration of about forty states, not a unified nation-state) registered differences between one thousand and ten thousand pounds per cow.¹⁰

To contemporaries, large local and regional differences in milk performances were evident. The productivity of the cow, as farmers knew, was a question of nature and nurture, of innateness and labor. Soil fertility, the specific breed, lactation stage, seasonal and day-to-day variations, and many other factors influenced the quality and quantity of a cow's milk. Most notably, it was a question of determining goals and labor input. One had to make a choice. Dairy farming required specialized skills and working conditions. It was elaborate and risky. The cow had to be treated carefully at all times. Skillful management and humane care were fundamental attributes of a cow's caretaker. Although the mechanistic worldview of nineteenth-century life sciences and economics led agronomists to define animals in terms of machines,¹¹ an individual farmer would never treat a cow that way.¹²

From this point of view, "high-yield" becomes a very relative term. This label reminds us that the improvement of an animal's body presumably is caused by a complex of different practices for using and managing bodily capacities. Therefore, a deterministic view of progress is not helpful when investigating the story of the high-yielding cow. In my judgment, the high-yielding cow is a result of various contested representations, practices, and economic problems, rather than a product of scientific research. Instead of succumbing to a simple model of "improving nature," we should examine the new forms of communication and new intellectual configurations that emerged in the nineteenth century and shaped agriculture as well as science. The high-yielding cow tells the story of a new culture of competition, measurement, selection, and predictability. It is a figure that provides evidence of the shift from local practices to networks of impersonal information, from local relations between landscape, animal, and people to large-scale institutions and control mechanisms.

This essay focuses only on the early phase of fundamental cultural and intellectual changes that transformed the cow into a competitive animal devoted exclusively to the production of milk. I will begin by reviewing strategies showing agricultural improvements in the late eighteenth century and trace some of the changes in the cattle trade, breeding, and dairy practices in the nineteenth century. Drawing upon source material from Germany and Switzerland, I hope to demonstrate that, as early as the beginning of the twentieth century, all relevant categories that define today's cows had already been established.

Soil, Animal, and Fodder as a Unit

The production of dairy goods, in the sense of butter- and cheese-making, has a long commercial tradition in Europe, but the cow was employed for this purpose only under specific regional conditions.¹³ Making milk, butter, and cheese was part of the way people understood and were engaged with their

local landscapes, both practically and symbolically. The saying "Dairy farming is land use"¹⁴ was just as self-evident as the idea of a "dairy zone."¹⁵ Agricultural boundaries were drawn in different ways, one of which was the dairy zone. It was conceptually well-defined in the sense that it was perceived as having clear-cut natural limits. As one agrarian writer put it in 1853, most plants and animals have their natural habitat, outside of which they do not exist.¹⁶ Depending on the perception of the landscape and its potentialities, people created certain modalities, skills, and techniques for appropriating local environments. Thus, the meaning of an animal's capacities and assigned tasks was rooted in the perspective of commitment to one's surroundings. "Locality" and "identity" were aligned for both humans and animals. Dairy farming was a situated knowledge and activity.

But a given landscape is not only a product of natural resources and of human activities (together producing the environment), it is also a place full of memories. Even after an environment has effectively changed, farming practices can continue to be a repository for traditions. In fact, specific ways of thinking about relations between animals and land reflected the long-standing rule that animal production for human food depended heavily on the soil. Achieving a balance between agriculture for grain production and animal husbandry was one of the fundamental rules of all premodern farming systems.¹⁷ Unlike today, there was no market for animal feed. Quality and quantity of available fodder were instead dependent on the way the land was being used, that is, the relationship between all types of land management, such as arable farming, permanent meadows, forests, pastures, orchards, and vineyards. Today, subsidies and market access have resolved this issue. In earlier times, farmers were forced to a much greater extent to adjust farm management to the specific nature of available land resulting from existing geological formations, soil conditions, elevation, climate, and vegetation.

As a result, cattle husbandry became dominant only in those regions where farmers faced problems with grain production. High altitude mountain meadows as well as coastal wetlands, river meadows, and highland and lowland moors were such places. Besides such coastal regions in Holland, Denmark, Ireland, and Sweden, the northern Alpine countries, in particular, had already established a pronounced and often highly developed dairy farming system in the sixteenth and seventeenth centuries.¹⁸ Not technical expertise but site-bound meadow farming was the starting point of Swiss cheese's road to fame. In the regions more heavily oriented toward arable farming, milk from cows, goats, and sheep was at best a byproduct of animal husbandry, available in pitifully insufficient quantities and on a seasonal basis only.¹⁹

Although most premodern farmers in Europe owned cattle, all accepted the rule that milk cows only made sense in meadow farming regions. An old farmer's adage holds that "Cows give milk through their mouths!"²⁰ According to old beliefs, milk was a foodstuff that had been transformed in the animal

body. Since antiquity, scientists, physicians, and ordinary people believed that food was regularly transformed into blood, which then circulated through the body in order to feed it. This steady cycle was only interrupted after giving birth. The Aristotelean (and folk) tradition accepted without qualification the notion that menstrual blood was redirected to the breast or udder and then reappeared in the form of milk.²¹ Cartesian physiology assumed that the chyle (the nutritional juice built during digestion) was pressed into the breast. At any rate, it was not until metabolic theories associated with the new field of organic chemistry were well established that these old beliefs were eradicated. As late as 1842, Justus von Liebig polemicized against the old ways of thinking in his *Animal Chemistry*. Whatever the exact mechanisms of transmutation involved, to him and his fellow chemists it was undeniable that "the herbs and roots consumed by the cow contain no butter."²²

Early Stages of Agricultural Modernization

The grand notion that the essential elements of dairy farming were soil, fodder, and animal inhibited the development of dairy farming in regions with diversified agriculture. Farmers in grain production regions as well as in preindustrial dairy zones had to grasp the idea that butter and cheese could be produced year-round in all landscapes.²³ The rise of industrialized milk production depended on two crucial preconditions: separating arable farming and animal husbandry and thinking in terms of different branches of production.

The first challenges to the old agricultural systems occurred in what Paul Bairoch called the "organic phase"²⁴ of agricultural modernization, beginning in the late eighteenth century and lasting until the 1870s. In this period the traditional relationship between land, fodder, cattle, and dairy production had been torn apart. In the discourses that marked agricultural reforms, natural spaces were reevaluated, but not with the specific purpose of improving animal production or dairy farming. The industrialization of dairy farming in the sense of establishing a complex technical system from barn to storage began not before the last quarter of the nineteenth century.

Around 1760, proponents of the new physiocratic school of economic thought began to argue for reforms that would improve the arable farming system. To the physiocrats, land was deemed the key to economic progress.²⁵ The idea was to accomplish a fundamental land reform, with a view to using the natural nitrogen cycle more effectively. To reach this goal, more dung had to be produced. Consequently, all of the physiocrats' proposals and measures for agricultural reform were based on four innovations: (1) abolishing the old style of meadow farming in all arable farming regions, that is, no longer allowing land to be fallow and parceling out communal pastureland; (2) planting fodder plants, such as clover and sainfoin; (3) summer stall feeding, to make it easier to collect cattle dung and liquid manure. The added quantities of cattle dung could be used to (4) ensure that fields and meadows were fertilized more

intensively. Implementation of these ideas was very controversial and took several decades. Nevertheless, the rising interest in livestock farming also meant new opportunities. As agricultural reform began to take effect, enterprising farmers learned to benefit from the “animalization” of field crops, as Curt Lehmann, a professor of breeding science, put it in 1874.²⁶

Since the 1840s, livestock husbandry, long regarded by many central European farmers as useless and burdensome, suddenly seemed profitable. Developments in international grain markets created the harsh framework for this change of heart. Europe's last major famine occurred in 1846–47; in the years that followed, the liberalization of the grain trade and the effects on distribution of an increasingly wider and more closely linked network of railroad lines offset an under supply of grain, and not just at the local level. National and international markets established themselves for the long haul and were soon followed by price wars. Agriculture based traditionally on grain production became unprofitable and needed to be replaced with other sources of income.²⁷

Suddenly many farmers in the grain-growing regions hoped to increase their incomes through artificial meadows or artificial feed and expanded cattle husbandry.²⁸ Formerly neglected fallow land attracted increasing interest;²⁹ schools for land improvement were founded; and the profession of the so-called *Wiesenbaumeister* (Master of greenland) developed.³⁰ Regions where, despite all the natural advantages of abundant vegetation, farmers had stubbornly adhered to the practice of planting grain, also reacted. One example was the Allgau region in the area at the foot of the Alps, where, around the turn of the nineteenth century, “farmers, having received foreign ideas, thought of the natural possibilities of . . . making the ‘yellow’ and ‘blue’ Allgau (flax growing) into the blossoming ‘green’ Allgau.”³¹ This reorientation was so radical that today, in the Bavarian part of the Allgau, the farm landscape is said to have been completely “greened,” and local officials advertise with an image as Germany's traditional dairy zone.

When the feeding situation improved, the next step, logically speaking, was to bring dairy farming into the former grain production areas. Although the intention was not to produce a dairy cow, for the first time the notion of a milk-producing cow as an isolated natural entity became a real possibility. The separation of land and animal permitted the construction of a self-evident form of animal production. A system of animal breeding, feeding, and husbandry was emancipated from its cultural roots and imagined as a separate branch of production. Swiss author Jeremias Gotthelf, in his 1850 novel *Die Käseerei in der Vohfelden* described with stunning acuity how cows made land more arable:

clover, sainfoin, and alfalfa came into the land, and stall feeding became possible, the forests were opened-up, meadows made arable and potatoes planted “en masse,” not just as a sort of dessert. Where cattle were in stalls, there was dung,

large and small dung, and it was used copiously and sensibly. As more dung was available, arable land grew, as did the herds of cattle and specifically the cows that could be used. . . . As the number of cows grew, so did the milk, for everything is interlinked, and one grows from another in an uncommon manner, and often in such a fine line that man does not even see the thread, a much finer thread than between cows and milk.³²

A First Cattle Boom

One result of this reorientation was a growing interest in the cattle trade in Europe's former grain production areas. In general, livestock import and export were not new phenomena. While trade concentrated on oxen, sometimes even cows were traded when they were descendants of cows from one of the European dairy zones. By the seventeenth and eighteenth centuries, cows from the North Sea coast and from Switzerland were already quite famous because of their milk. It was said that the landscape, climate, and living conditions had induced natural selection and produced the ability to give high-quality milk.³³ Most of those who imported these cows hoped to acquire the art of cheese- and/or butter-making. Several estates did so in the eighteenth century, but they made little profit if they did not import the herdsmen as well. Even today the names of villages and landscapes in the region around Berlin tell a tale of where the *Holländer* (the Dutch) settled.³⁴

While this early trade in cows was limited, the new interest in livestock farming popularized ideas about the economic benefits of dairy farming cows. In the decades following the defeat of Napoleon and the creation of the German Confederation, Prussia's landowners with large estates indiscriminately imported every type of European cattle purported to be good milk and/or meat producers.³⁵ The imports, especially of well-known stocks from Netherlands and Switzerland, increased considerably. Meitzen reported for Silesia that the cattle boom started with imports from Switzerland. Later, cattle from Oldenburg and Frisia followed, then from Tyrol, Danzig, and Murztal, followed by imports from the Netherlands, Holstein, and England.³⁶ Between 1820 and 1870, farmers in the western part of Prussia imported bulls from most regions of Europe solely to improve the milk and meat output of native cattle.³⁷ By the 1820s, new breeds had been developed. In Rosenstein, Württemberg, the so-called *Rosensteiner Rindviehviehstamm* was said to be a cross between the *Holländer*, *Schwyzer*, and native cattle.³⁸

Before the nineteenth century, high-quality butter and especially fatty cheese were expensive lifestyle products, so much so that German landowning nobilities imported cows for their personal use. The goal of investigating Swiss or Dutch cows and recruiting dairy farmers was not, for the most part, the establishment of commercial dairy farming. Most people did not expect to become successful dairy farmers. As noted above, dairy farming was considered a situated knowledge. The animal and its products were symbols of specific

landscapes. Because the Swiss cow represented the Alps and the vigor and health of Alpine herdsmen peoples as well, landowners hoped to import a taste of the Alpine terrain. To the educated classes in Europe the fame of mountainous milk products was such a cliché that travelers were surprised not to see cows "*walking up to their bellies in grass.*" Ludwig Wallrath Medicus, a German author who in 1795 wrote a report on Alpine farming, was certainly disappointed to find "*just short and rather low grass.*"³⁹

As European farming regions began realizing the economic potential of dairy farming and investing in milk cow breeding to make use of this potential, the question of criteria for assessing quality in breeding became more urgent. What constituted a "good" cow and how could one evaluate cows on the livestock market? With the increasing transportation of cattle from one place to another, agricultural reformers expressed their fears that cattle imports confronted farmers with too many technical and financial difficulties. On the one hand, the farmers often scorned native varieties, regarding them as useless mongrels that had been mixed indiscriminately and did not contain "improved blood." On the other hand, they criticized the uncontrolled purchase of new stock for breeding purposes.⁴⁰

As early as 1780, an agrarian writer reported that those farmers in grain-growing regions of northern Germany who had bought big Dutch swampland cows were turning no profit on this investment. In the author's opinion, farmers were not able to deal with these cows for two reasons: first, poor fodder, and second, the farmers' incompetence in dairy cattle husbandry.⁴¹ Another agrarian writer commented laconically on imports made by estates owned by the gentry: "The gentlemen's follies are instructive."⁴² While skepticism about famous breeds with remarkable performance records among farmers increased and random breeding with local cattle was criticized, old views about the interrelation between soil, form, and performance were remembered more and more often. "Where soil is meager, the animal can't be fat" was an often-repeated insight.⁴³

Altogether, practical experience with imports was disappointing. Rather than enjoying flourishing milk production, farmers in former grain production regions and agronomists were confused and dissatisfied. Uncertainty about the respective merits of famous dairy cattle breeds made it clear that breeding was a mystery even to the successful. Judging the capacities of an animal solely on the basis of ancestry seemed inadequate for establishing new breeds and a flourishing dairy farm. The sobering estimate of Charles Flint, an American author of manuals on dairy farming, might also have been published in Prussian Germany. Flint wrote in 1858:

To work successfully with our common cattle would require great experience, a quick eye for stock, a mind free from prejudice, and a patience, and perseverance quite *indefatigable*. . . . This mode would require a long series of years to arrive

at any fixed and satisfactory results, owing to the fact that our "native" cattle, made up as they are of so infinite a variety of incongruous elements, do not produce their like, that the defects of an ill-bred ancestry will be continually "cropping out" for several generations.⁴⁴

The Cattle Exhibition—Institution of Competition

For the old livestock farming regions, the situation was far better. Since the 1780s, when livestock farming became more fashionable in arable farming regions, the livestock breeding business underwent economic crises as most farmers were unable to serve the changing interests of the market. The old cattle trade was organized around oxen as working animals and dung producers; the renewed market exchange called for meat and milk. While famous British breeders like Richard Bakewell and Charles Colling since the late eighteenth century set about increasing their profits through the "improvement" of their beef-producing livestock, early breeding of dairy cows took place in Switzerland.⁴⁵ Livestock export had influenced the economies of several Swiss cantons since the Middle Ages.⁴⁶ Thus, Switzerland had a well-established cattle trade in the beginning of the nineteenth century. However, it was not common to focus breeding on cows or milk performance. Livestock farming for export, in general, did not follow a dairy tradition because milk was almost completely used to feed calves. It was not until local authorities acquired a sense of dairy cows' sales value that the promotion of dairy cattle breeding began.

Within the physiocrats' debates on agricultural reform, it was not farmers but politicians, priests, schoolteachers, and veterinarians who became aware of the differences in animal husbandry in different Swiss cantons. They decried the poor condition of cattle husbandry and the animals' poor health and began debating ways out of the crisis. The physiocratic societies founded commissions to improve cattle, sent authorized agents to visit local farmers, and distributed questionnaires to local authorities.⁴⁷ Several livestock farming cantons like Uri, Schwyz, or Unterwalden were investigated to determine whether the good condition of their livestock farming was the result of specific skills or favorable natural conditions. The commissions were specifically interested in ascertaining what role the cattle trade played in a community, inquiring as to whether communities held enough cattle to turn a profit, which stocks were doing well or poorly, or whether farmers had enough fodder for the winter.

In general, the authorities were not satisfied with the findings of their observations. Two results—subsequently debated by the state economic commission of the canton of Berne from 1803 to 1806—are especially relevant here.⁴⁸ Farmers in wealthy livestock farming regions distrusted imported cattle. Furthermore, they did not like to rent out their mountainous meadows to feed foreign cattle.⁴⁹ For them the interrelation between soil, animal, and performance was a traditional one that they did not want to change. Members of the commission interpreted these results to mean that a prohibition of cattle

imports in such regions might be in order. A second observation taught them to organize competitions instead of using sanctions or coercive measures. Farmers' reactions were cool and bull-headed if agricultural reformers gave instructions. It proved more effective for local authorities to offer cash premiums paid periodically as a disincentive to prevent the interbreeding of various cattle strains.

These proposals were quickly accepted by the local authorities. On April 23, 1806, the small council of Berne decided to create local stud books, to grant prizes, and to organize cattle exhibitions. A few weeks later, the state economic commission sent procedural rules to all communities in the canton of Berne. One rule fixed the prizes to be awarded and determined which proportion of profit should be given for the best stock bull and the best cow. Age requirements for participating animals were set as well as a time period in which the sale of prize-winning animals was prohibited.⁵⁰ Above all, authorities developed an evaluation philosophy. The respective juries were to judge nothing more than the form, the physique, and the beauty of an animal. Fat, height, and pregnancy were not to be taken into account. Height, for example, was to be ignored because the mountainous stocks in general were smaller than animals living in valleys.

In autumn 1807 the first cattle exhibition took place in the canton of Berne; the event immediately served its purpose. Farmers from the different villages, communities, and regions competed with one another. The rivalry here was different from that which characterized the old cattle markets. The aim was not to achieve a good price then and there. Awards were not short-dated bills but rather prospects for future profits. Above this, cattle exhibitions were educational measures that intensified local and regional competition. In fact, only two years later, the state economic commission found evidence of positive effects. Exhibition reports revealed that some villages and communes had already improved their cattle. The animals sent to the farm shows were clearly of higher quality than those on view two years earlier.

Before long, other cantons followed suit. In 1811 the city fathers of Luzern passed regulations governing the scheduling of cattle exhibitions at regular intervals. In 1818 the local government of the canton of Luzern awarded prizes for sires for the first time, and in 1837 the law on cattle exhibitions ("Gesetz über die Schau von Zuchtvieh") was passed.⁵¹ When the first cattle exhibition in the canton of Appenzell was planned in 1846, the organizers hoped to profit from the long-standing experience of other cantons.⁵² The goal of these measures, to direct farmers' attention to cattle breeding, was reached. By the 1860s, cattle exhibitions in combination with annual fairs were well established in many Swiss cantons. Swiss cattle were sent to world exhibitions in Paris in 1855 and London in 1862 for the first time. To convey a consistent image of the Swiss cow, delegates took with them only two stocks—the *Freiburger* and the *Schwyzer*. A report from the London exhibition outlined tasks to follow these

competitions. The author linked the establishment of the Swiss confederation in 1848 not only to citizenship but also to standardized Swiss cattle.⁵³

Pure Bred Cattle and Herdbooks

Those who promoted dairy farming also evaluated the landscape in terms of its meaning for nation and society. Agricultural reformers soon described dairy farming as a kind of political economy. "Milk is the fundamental material of our nation, to build and support its ability to work," wrote Rudolf Schatzmann, a priest who was active on behalf of Alpine dairy farming.⁵⁴ A strong relationship between self-image, state of mind, landscape aesthetics, and dietary habits was constructed and became an important element of the Swiss nation's specific symbolic representation. The healthiness of milk and cheese was to become one of the most prominent features of this self-image.⁵⁵

Because the cattle exhibitions became events of national interest, it is no wonder that agricultural reformers began thinking about the universal character of the nation's cattle. Local cattle lacked distinguishing characteristics. In the early nineteenth century, cows in dairy zones as well as in other regions were a motley lot; they varied in size, shape, and color. They were the result of unintended cross-breeding within herds, or because they roamed and bred freely, they reflected geographical characteristics. In any case, they were not uniform. Within the new culture of competition, it was of national interest to find a consistent appearance for local cattle. For Swiss agricultural reformers, the task was to ascertain external traits that marked the already famous dairy cow. The existing agricultural literature was of no help. At best, agricultural writers differentiated between so-called lowland and highland cattle.⁵⁶ In a country like Switzerland all breeds counted as highland animals, regardless of other traits.

Because animals are characterized by unique physical and behavioral traits, the notion of breeds exists primarily as a social construct. That is, in order for a breed to exist, enough people have to agree that the animals in question are sufficiently distinct from other breeds. One of the first activities to initiate the social construction of a breed of cattle was the demarcation of geographical boundaries. In other words, reformers tried to stop cattle trading for the purpose of breeding. Second, it seemed necessary to define uniform breeding procedures. However, which prominent features could be identified and should be conserved? What was the true type cow or a dairy animal at all? And besides developing detailed classifications for describing such cows, how could one attain new breeding goals?

For centuries Swiss livestock farming concentrated on breeding bulls. Cows had been part of the reproduction cycle; their milk was needed almost exclusively to suckle young cattle, with little left over for butter and cheese.⁵⁷ With the international recognition of the Swiss cow, specialized breeds not only replaced diversity but also concentrated on the milk cow. Although only a small fraction of the national herd consisted of animals that were recognized as

belonging to definite breeds, in the 1880s the quasi-official Swiss cow was the *Schweizer Braunviehrasse* (Swiss Brown Race). All other breeds, such as the *Appenzeller*, *Hashtaler*, *Prättigauer*, and many more, continued to exist on farms, in villages, and in the minds of the people.⁵⁸ But the breed that was sent to exhibitions, which existed on paper and was thought to be the origin of the first Swiss herdbook of 1879, was the Swiss Brown Race. Only one year before, in 1878, the herdbook of eastern Frisia dairy cattle (*Heerdbuch für Ostfriesisches Milchvieh*) had been founded by the association of Frisian farmers (*landwirtschaftlicher Hauptverein*).⁵⁹ During the following years, herdbooks sprang up all over Europe.⁶⁰

Documenting breeding results was by no means new.⁶¹ The use of stud books by horse breeders had become quite common with cross-breeding in the eighteenth century. It was in 1791 that "An Introduction to the General Stud Book" appeared for the thoroughbred horse in the United Kingdom, and in 1822 the Shorthorn Cattle herdbook was founded, the world's first such book. Later, the organizers of cattle exhibitions sometimes began to produce herdbooks. However, those early registrations only recorded animals if they won races (horses) or were prize winners at agricultural shows. To normalize herdbooks was not easy. In the beginning, breeders often refused to give pedigree information about the animals they sold, fearing they would be giving away "trade secrets." A first attempt at listing all German breeds (cattle, sheep, and pigs) was launched in 1864. By 1872, when the book was closed, the herdbook of all German breeds (*Stammzuchtbuch Deutscher Zuchtherden*) comprised seven volumes.⁶²

The golden age of herdbooks that began in the 1860s resulted in changes in assessment methods. However, a whole range of criteria for selecting milk cows had existed prior to this development. From "feminine appearance" and "soft temperament" to "transparent horns" and good digestive powers, externally indicated by a "large mouth, thick, and strong lips," all descriptions made sense as very subjective judgments. Farmers did not make their decisions about desirable or inferior physical forms and qualities with the help of lists of traits. Long experience with animals taught them to assess the characteristics of every part of the body.⁶³ Agricultural literature then, very often reflected popular thought or individual experience; one example is Francois Guenon's "milk mirror" (a pattern of hair growth around the udder).⁶⁴ With the rise of herdbooks, however, the cultural and intellectual climate changed. To breeders, the classification of dairy cattle became a more objective measurement, independent from local customs and local knowledge.

National standards of appearance, height, weight, and performance, as well as methods of measurement and rating required a process of standardization. Standardization, however, entails new organizations. In fact, beginning in the 1860s, breeding became more clearly separated from farming and animal hus-



Fig. 6.1 "Competing Animals"—On the left, the cow named Queis from an Eastern Prussian breed, on the right a "local" cow, as shown at the jubilee cattle exhibition, Königsberg 1913
 Source J Hansen, *Lehrbuch der Rinderzucht Des Rindes Körperbau, Schlage, Züchtung, Fütterung und Nutzung* (Berlin 1921), 15

bandry.⁶⁵ And because more and more Swiss farmers tried to take up the dairy business by themselves, they lost interest in the breeding business. The work of breeding was affected by this tendency; after 1850 and especially in the 1870s many cattle dealers were accused of shunning Swiss breeders and importing low-grade animals, as one chronicler claimed.⁶⁶ This was the background for the twofold task facing the first Swiss breeding cooperatives, which began developing after 1887. One goal was to bring together like-minded people to support one another. As organizations, however, they were also supposed to represent improvement strategies and the use of well-established breeds. As one author, a veterinarian from the canton of Freiburg, put it in 1892, breeding associations were the best instrument for maintaining the purity of a clean breed because they promoted self-discipline within the breeding community.⁶⁷ In particular, control by fellow members was seen as a means of accomplishing the objectives of the organization, namely, ensuring compliance with regulations and providing for the external recruitment of stock bulls. Besides organizing and managing cattle exhibitions, one of the most important tasks was the business of writing herdbooks.

Herdbooks became the central documents of classification. While several descriptive terms distinguishing animals were in common use (e.g., scrub or mongrel, cross-bred or pure-bred), the system of herdbooks formulated scales of points that were designed to aid in acquiring the skills needed to select cows by conformity. A scale of points was utilized to describe the constitution of an animal that, in the opinion of the authors, represented the best manifestation of the characteristics sought. One can imagine that agreeing on a scale of

points was a highly contested terrain, because it was difficult to formulate a suitable classification that served to define the so-called pure breeds. As already mentioned, one means of control was to draw boundaries around a geographical terrain. Since the animals might vary greatly within a breed, a second step was to define terms of body description. The first Swiss Brown Cow herdbook of 1879 (*Verzeichnis edler Thiere der Braunviehrasse*) included not less than twenty-three body characteristics and positions that had to be evaluated.⁶⁸ Every animal had to be measured and weighed.⁶⁹ The results were coded in registers; each item got its own score.

Later, pedigrees were mapped; every animal selected for breeding purposes got its own pedigree, it was "identified." Thus, individuals' characteristics were transposed from spoken to written language. With the use of pedigrees and written documentation, telling a story of origin was in fact an administrative act of authentication and identification. Within a few decades, the use of written documents in the administration of cattle became a matter of course. The bureaucracy of breeding was rounded out with instructions and guidebooks for farmers and breeders. Even breeders' associations received instructions on how registers were to be kept in an adequate and orderly fashion.⁷⁰ Animals were "baptized," and the date of birth and the name of the father and mother legally attested to in a kind of "passport." To prevent mix-ups, all animals received an ear tag. Finally, new identification skills, such as the use of the medium of photography, became popular. Photography was said to be a useful teaching aid.⁷¹

In any case, standardization processes and the administration of body characteristics played an important role and became a major task in the breeding business. Together with the emergence of a centralized state and large-scale economic institutions, the demand for a more rigid and comparable definition of "race" brought not only a new type of breeder but also scientists into the breeding business. With increasing professionalization of the breeding business, a growing number of actors participated in the definition, control, and management of pure-bred animals. In 1881, the newly founded University of Agriculture (*Landwirtschaftliche Hochschule*) in Berlin established the first chair for breeding science.⁷² Soon, other universities followed.

The True Type Cow

While the second half of the nineteenth century saw an expanding exchange of technical information about individual cows and bulls, the question of how to "identify" performance remained unsolved. Of course, the simplification and standardization of dairy cattle became a specialty of the old dairy zones in northern Europe (Netherlands, Denmark, England, Schleswig-Holstein in Germany) and in Switzerland.⁷³ Yet, until the turn of the century no breeder would have bred a cow for just one purpose. As yet, no single, entirely satisfactory way of selecting cows for dairy purposes had been identified. An animal's

regional provenance, in combination with the description of body characteristics, the so-called *exteneur* (appearance) seemed to be adequate criteria.

In general, breeding for special purposes was still unusual and the combination of geography and genealogy much more important. The true type cow remained a question of aesthetics: "plain, substantial, and well-proportioned—although rather fleshy—. . . somewhat coarse in the bone and in general make-up . . . large, well-shaped udders with teats of sufficient size to be milked conveniently. . . milk veins and milk wells of medium development"⁷³—these descriptive phrases, for example, were used to describe the functional type of the Brown Swiss cow to American students and dairy farmers in 1924.⁷⁴ The same author described the general characteristics of the dairy type as follows:

A person familiar with cattle in general, but not with highly developed dairy cattle, looking for the first time upon a high-class dairy cow in full flow of milk would have his attention especially directed to three points as follows: 1. The extreme angular form, carrying no surplus flesh, but showing evidence of liberal feeding by a vigorous physical condition. 2. The extraordinary development of the udder and milk veins. 3. The marked development of the barrel in proportion to the size of the animal.⁷⁵

Of course, such traits in the development of the true dairy type were very controversial among experts. Especially the question of whether a good cow must have a big udder was debated again and again.⁷⁶ For these reasons, it seemed inadequate to define breeds by body characteristics or to present the merits of a regional breed. More and more frequently, aesthetic criteria were criticized. As a German professor of agriculture at the Technical University in Munich wrote in 1899: "Even at the well-organized exhibitions of the German Society of Agriculture (*Deutsche Landwirtschaftsgesellschaft*), it is possible to win a prize with a cow of lesser value, just because the juries award prizes to the most beautiful, pure bred cows but not to the high-performance animal."⁷⁷

But the problem remained: How could criteria other than the aesthetic ones be applied and assessed? Furthermore, how could characteristics be transmitted to the future generations of milk cows? For breeders it was a long-standing fact that when any characteristic or function had been developed to a high degree in a breed of animals, the acquired characteristics might not be transmitted uniformly.⁷⁸ There was an ever-present tendency for some of the ancestors' characteristics to reappear. The more highly developed the animal, the more difficult it became to retain desirable acquired characteristics. Moreover, breeders were aware that even a well-marked breed, if exposed to greatly changed life conditions, might produce further variability. At any rate, farmers expected wide variability in the capacity of individual cows to produce milk. It was (and is, until today) not uncommon for one cow to produce four, five, or

even more times as much milk as another individual of the same breed held under similar conditions in the same herd.

It was Charles Darwin, who, in his book *The Variations of Animals and Plants Under Domestication*, written in 1868, introduced the term "variability" to describe these well-known rules of inheritance.⁷⁹ Darwin demonstrated great respect for the business (he would have said art) of breeding. Because new strains or sub-breeds are formed so slowly that their first appearance passes unnoticed, he was aware that one needed much sensitivity and perhaps even more hands-on experience to become a successful breeder.

Keeping Milk Records

The professionalized dairy cattle breeder looked for methods to master the phenomenon of individual variation in performance. Breeders found a solution in milk records.⁸⁰ Since the 1860s, test milking had been undertaken sometimes during cattle exhibitions to aid juries in assessing cows. However, by the end of the nineteenth century, things had changed completely. Not surprisingly, the herdbook societies were among the first organizations to call attention to the importance of milk records as a criterion of performance. At its founding meeting in November 1893, the Herdbook Society of the Allgau (*Allgäuer Herdbuchgesellschaft*) decided to require that its members provide milk records, since the majority considered them to be a helpful tool in improving yields.⁸¹

The first incorporated society to test cows through complete milking periods was founded in northern Germany in 1895.⁸² A union of thirteen breeders in Vejen, near the border of Denmark, copied a system they had learned about from their Danish counterparts. These farmers employed an inspector for two reasons. First, they wanted to identify the best cows in order to gain information on hereditary potential. Second, they wanted to ascertain the amount of milk and fat produced in direct relation to the cost of feed per cow. Thus, milk records became a method for analyzing production costs, and it is not surprising that this idea first emerged in Denmark. After Denmark had lost Schleswig-Holstein to Prussia in the war of 1864, it switched to a more intensive type of agriculture based on importing grains and growing fodder crops and feeding both to livestock for the production of bacon, butter, cheese, eggs, and meat. In contrast to German farmers, it had become routine for Danish farmers very early on to compare feed costs with the prices they got for milk and butter.⁸³ These farmers had observed that, as milk yield increases, there is also an increase in the total cost of feed and other items; however, yield and costs do not increase constantly in the same proportion. If one compared the relative cost of producing one hundred pounds of milk, then yield differences observed between a very poor cow and a cow of medium quality proved to be much greater than those that distinguished a good cow from a medium quality

cow. The consequence was obvious: the most rapid way to achieve herd improvement was to eliminate cows with the lowest milk yields.

Thus, the Danish farmers exported not only butter to their neighbors but also the insight that the more you know about each cow, the more efficient your herd might become. This idea spread rapidly. Other societies of the same kind were founded, not only in Schleswig-Holstein but all over Germany. In 1900, only four societies for testing cows existed in the German Reich; by World War I, the number of societies increased to 792, controlling about 350,000 cows (3.4% of all German cows). In 1933 the number was increased to 2,897 societies.⁸⁴ At this point, the German Society of Agriculture (*Deutsche Landwirtschafts-Gesellschaft*), the headquarters of cattle exhibitions, decided to follow the example of Denmark and Sweden. Only tested animals were allowed to participate in cattle shows.⁸⁵ Moreover, breeders were asked to publish their milk testing results at exhibitions and markets. The effect was that breeding organizations now were forced to generally test their animals. From then on, the circulation of milk performance data became more and more common. And when milk distribution became a business in itself, cow testing and milk records were used to control contracts between dairy farmers and milk distributors. Soon, there was a call for neutral, state-organized milk-control boards or milk commissions, with the power to negotiate a balance between the interests of producers and those of distributors and to establish milk prices for producers and consumers. When, in 1935, Nazi officials forced every German farmer to be associated with a dairy, it was only a small step from there to keeping milk records for every cow.⁸⁶

Conclusion

Of course, the story told so far has not yet come to an end. Not unexpectedly, as milk records became a standard in dairy farming, other questions became more important for the dairy industry. How can dairy cattle be fed more efficiently? What is the cheapest fodder regime in relation to top milk output? Other stories that might be told are the implementation of statistics in the breeding business since the 1920s, the introduction of artificial insemination since the 1940s, and, last but not least, the normalization of reproductive technologies, hormone research (e.g., the controversial question of bovine growth hormone BST, bovine somatotropine), and, finally, cloning in cattle breeding.

My goal in this essay has not been the production of a general history of the high-yielding cow, nor has it been a general essay on breeding technologies and breeding knowledge. Rather, I have probed different data from agricultural history to understand how knowledge about cows and human relations with cows changed in specific local settings. Since the end of the eighteenth century, three major developments or transformations have been at work to change the perception of the cow. First, the idea of separating soil, landscape, and animal

husbandry and assessing individually every part of what was formerly an "organic" farming unit took hold. This step resulted in a substantial and sustained rise of interest in animal husbandry. Farmers in the grain-growing regions hoped to increase their incomes through cattle husbandry; this in turn promoted the cattle trade in Europe. Second, with the new livestock evaluation methods at exhibitions, new forms of competition and new impersonal methods of classification emerged. And third, linked to these developments, we have observed a rising influence of standardization in the agrarian context, leading to changed perspectives on the cow. To sum up, today's high-yielding cow came into being within a new culture of competition, standardization, performance control, selection, and predictability, forcing farmers and new institutions like breeding organizations to search for methods and technologies to improve milk yields.

Notes

I thank Paula Bradish and Susan Schrepfer for their helpful suggestions and assistance in translation.

1. Albrecht Thaer, *Grundsätze der rationellen Landwirtschaft*, vol. IV (Berlin: Reimer, 1812), 344.
2. Viehbahn took great pains to collect data from different sources (official statistics, agricultural literature, calendars, journals, and so forth). He had to take into account that there existed only local milk markets. See Georg von Viebahn, *Statistik des zollvereinigten und nördlichen Deutschlands*, 3 vols. (Berlin 1858–1868: I. Landeskunde, 1858; II. Bevölkerung, Bergbau, Bodenkultur, 1862; III. Tierzucht, Gewerbe, Politische Organisation, 1868), vol. III, 509. Quite the same data are published in Hans Wolfram Graf Finck von Finckenstein, *Die Entwicklung der Landwirtschaft in Preussen und Deutschland 1800–1930* (Würzburg: Holzner, 1960), 10. General data on the agricultural production are explored in Eberhard Bittermann, "Die landwirtschaftliche Produktion 1800–1950," *Kühn-Archiv* 70 (1956): 1–149.
3. For the Swiss data see Bundesamt für Statistik (ed.), *Statistik Schweiz, Land- und Forstwirtschaft, Milchproduktion und –verwertung 1980–2001* (Neuchâtel: Bundesamt für Statistik, 2001), retrieved May 5, 2003, from <http://www.statistik.admin.ch/>. For Germany see Milchindustrie-Verband e.V., Milch & Markt Informationsbüro (ed.), *Zahlen und Daten der deutschen Milchindustrie* (Bonn: MMI, 1998) retrieved September 24, 2002, from <http://www.zmp.de/milch/marktkommentar.htm>.
4. The world milk production averaged 491 million tons in 2001, with an average increase of 0.7 percent in the past five years. The European Union is still the biggest milk producer (122.2 m.t. in 2000) in the world, with Germany as the biggest milk production country in Europe, retrieved May 21, 2003, from http://www.rentenbank.de/deutsch/bank_d/veroeffentlichungen_d/geschaeftsbericht_d_2001/Seite_14_31_2001.pdf.
5. Theodore Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton, N.J.: Princeton University Press, 1995).
6. See Alois Seidl, *Deutsche Agrargeschichte*, Schriftenreihe der FH Weihenstephan, Bd. 3 (Freising: Fachhochschule Weihenstephan, 1995), 177; Volker Klemm, *Agrarwissenschaften in Deutschland. Geschichte—Tradition. Von den Anfängen bis 1945* (St. Katharinen: Scripta Mercaturae Verlag, 1992), 272.
7. "The dairy industry owes much of its present economical and nutritional importance to the result of research in many different fields of scientific effort. Animal husbandmen, agronomists, plant and animal geneticists, bacteriologists, chemists, entomologists, physiologists, engineers, nutritionists—and a host of other scientific workers—have all made a contribution to the development of this great industry," wrote the U.S. Department of Agriculture, Bureau of Dairy Industry Report 1951, *Dairy Cattle Feeding and Management*, 4th edition, ed. H. O. Henderson and Paul M. Reaves (New York/London: Chapman & Hall, 1954), 1.
8. He mentioned 3,000 Prussian quarts (about 6,850 pounds). See August Meitzen, *Der Boden und die landwirtschaftlichen Verhältnisse des Preussischen Staates*, vol. II (Berlin: Wiegandt Schömpel, 1869), 501.

9. The von Thunen model is discussed in William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York and London: Norton, 1992), 42-54.
10. A full discussion of the Viebahn statistics is offered in Hans-Jürgen Teuteberg, *Die deutsche Landwirtschaft beim Eintritt in die Phase der Hochindustrialisierung. Typische Strukturmerkmale ihrer Leistungssteigerung im Spiegel der zeitgenössischen Statistik Georg von Viebahns um 1860*, Kölner Vorträge und Abhandlungen zur Sozial- und Wirtschaftsgeschichte, H. 28 (Köln: Forschungsinstitut für Sozial- und Wirtschaftsgeschichte, 1977).
11. In the middle of the nineteenth century the cow's productive capacity was quite often compared to a machine. As Sally McMurry points out, not only agricultural reformers but also farm journals used this analogy. See Sally McMurry, *Transforming Rural Life: Dairying Families and Agricultural Change, 1820–1885* (Baltimore: Johns Hopkins University Press, 1995), 23.
12. And they still don't today, see for example the complex instructions to manage high-yielding cows, at http://www.inform.umd.edu/EdRes/Topic/AgrEnv/ddd/business/BEHAVIOR_AND_MANAGEMENT_OF_HIGH_YIELDINGCOWS.html retrieved May 21, 2003.
13. The preindustrial dairy near cities is addressed in I. F. C. Dieterichs, *Ueber Milch- und Kuhwirtschaft im nördlichen Deutschland in Nähe grosser Städte* (Berlin: Verlag Karl Wiegandt, 1856).
14. Ida Schneider, *Die schweizerische Milchwirtschaft mit besonderer Berücksichtigung der Emmentaler-Käserei* (Zürich/Leipzig: Rascher, 1916), 7.
15. The dairying families in Oneida County, New York, thought this way. I took the phrase from McMurry, *Transforming*, 12–15. Even today, Italian farmers in a small Alpine village think in terms of dairy zones, see Cristina Grasseni, "Developing Skill, Developing Vision," unpublished Ph.D. dissertation, University of Manchester, 2001.
16. In regions with deciduous forest, he wrote, the farmer would be well advised to breed goats, rather than cattle or sheep, in oak and beech tree forests he should prefer pig breeding. Dry and spacious areas should be allocated to sheep, fertile gardens and orchards to bees, lush meadows to cows. See Ferdinand Stamm, *Die Landwirtschaftskunst in allen Theilen des Feldbaues und der Viehzucht. Nach den bewährten Lehren der Wissenschaft, der Erfahrung und den neuen Entdeckungen in der Natur, gründlich, faßlich und ermuthigend erläutert* (Prague: n.p., 1853), 372.
17. This problem is explored in detail by Friedrich-Karl Riemann, *Ackerbau und Viehhaltung im vorindustriellen Deutschland* (Kitzingen-Main: Holzner Verlag, 1953).
18. For the history of dairy farming in various European countries, see Patricia Lysaght, ed., *Milk and Milk Products from Medieval to Modern Times*, proceedings of the Ninth International Conference on Ethnological Food Research, Ireland 1992 (Edinburgh: Canongate Academic, 1994).
19. Here, the farmer was involved in a rural economy with primarily three-field or two-field crop rotation. The practice of growing different crops in different years on the same land in order to prevent the soil's nutrients from being exhausted did not leave enough food for large livestock. The same held true for pasture, forests, and allmende land. Thus, most cattle were slaughtered before winter set in, since there was no food to feed them and they provided meat during the coldest months. Cattle were kept for dung, meat, and work.
20. D. Rüger, *Die neue chemisch-praktische Milch-, Butter- und Viehwirtschaft*, vol. 1 (Löbau: Dummler, 1851), 7.
21. Even a late version of Albrecht von Haller's "Grundriß der Physiologie," first published in 1747, addresses this position. See *Albert's von Hatter Grundriß der Physiologie für Vorlesungen mit den Verbesserungen von Weisberg, Sömmering, und Meckel*, umgearbeitet von D. Heinrich Maria von Leveling, Theil (Erlangen: Walther, 1796), 755.
22. Justus Liebig, *Animal Chemistry in Its Applications to Physiology and Pathology* (Cambridge, Mass.: J. Owen, 1842), 82.
23. In the Alpine dairy zones, people thought that the best butter and cheese could be produced only on the high mountain meadows. An old farmer's proverb holds that the grass is always better the higher one goes, and at the top it is so good that even farmers might like to eat it. Quoted in Werner Bätzing, *Die Alpen. Entstehung und Gefährdung einer europäischen Kulturlandschaft* (München: Beck, 1991), 29.
24. Following this model the first "organic" phase started in the late eighteenth century and ended during the major depression that hit European agriculture from 1875 to 1890. The

- second phase is described as the mechanical phase, lasting until the Great Depression. The third phase is classified as being in the period of the welfare state and thus the post-World War II period. See Paul Bairoch, "Die Landwirtschaft und die Industrielle Revolution 1700–1914," in *Europäische Wirtschaftsgeschichte*, Vol. 3, ed. Carlo M. Cipolla and Knut Borchardt (Stuttgart/New York: Fischer, 1976), 297–332. Also Christian Pfister, *Im Strom der Modernisierung Bevölkerung, Wirtschaft und Umwelt im Kanton Bern 1700–1914* (Berne, Stuttgart, Vienna: Haupt, 1995), 176.
- 25 For this whole section, see Pfister, *Im Strom*, 175–202. Also Hans-Jürgen Teuteberg, "Anfänge des modernen Milchzeitalters in Deutschland," in *Unsere tägliche Kost Studien zur Geschichte des Alltags*, no. 6, 2nd ed., ed. Hans-Jürgen Teuteberg and Gunter Wiegmann (Münster: Aschendorff, 1986), 163–184.
- 26 Curt Lehmann, *Zur Frage über die Berechtigung einer stärkeren Viehhaltung im landwirtschaftlichen Betriebe*, Diss. Göttingen 1874, in *idem*, *Gesammelte Schriften*. Im Auftrage des Kuratoriums der Lehmannstiftung herausgegeben von der Deutschen Gesellschaft für Zuchtungskunde, 2 vols. (Berlin: Deutsche Gesellschaft für Zuchtungskunde, 1920), vol. 1, 2.
- 27 For the agrarian crisis in the nineteenth century see Bairoch, "Landwirtschaft", Teuteberg, "Anfänge", Walter Achilles, *Deutsche Agrargeschichte im Zeitalter der Reformen und der Industrialisierung* (Stuttgart: Ulmer, 1993), Tom Pierenkemper, ed., *Landwirtschaft und Industrielle Entwicklung Zur ökonomischen Bedeutung von Bauernbefreiung Agrarreform und Agrarrevolution* (Stuttgart: Steiner, 1989).
- 28 Data on the size and composition of cattle herds demonstrated the new priorities. In the canton of Berne, around 1760, the grain growing areas still had a large number of draft animals, particularly oxen, whereas in the mountainous regions the cows were in the majority, commensurate with their significance for cheese making. Transitional areas, also called field grass areas, were also already heavily oriented toward dairy farming. After 1790 (until 1911) the cow population began to outgrow that of horses, oxen, and sheep in all parts of the country to an incredible, yet varying extent. Pfister, *Im Strom*, 189.
- 29 In Prussia in 1840, about 20 percent of agricultural area counted as fallow land, in 1867 it was only 10 percent, by 1913 the percentage of fallow land had decreased to 2.7 percent. See Teuteberg, "Anfänge," 166.
- 30 See on this greenland movement Franz Hafener, *Der Wiesenbau in seinem ganzem Umfange nebst Anleitung zum Nivellieren, zur Erbauung von Schleussen, Wehren, Brücken etc.* (Reutlingen: n.p., 1847). The term 'greenland' in German means all agricultural area used for the production of fodder.
- 31 Walter Jahn, "Die allgemeinen physischen Faktoren der Landwirtschaft" in *Geschichte der Allgauer Milchwirtschaft 100 Jahre Allgauer Milch im Dienste der Ernährung*, ed. Karl Lindner (Kempten/Allgauer Milchwirtschaftlicher Verein, 1955), 20.
- 32 Jeremias Gotthelf, *Die Käseerei in der Vohfelden Gemeine Geschichte aus der Schweiz*, reprint of the edition of 1850 (Zürich: Rentsch, 1984), 235.
- 33 See Hans Eugster, "Zur Geschichte des Schweizer Braunviehs und seiner Organisation," in *Appenzeller Viehschauen*, ed. Maddel Fuchs (St. Gallen: Typotron AG, 1998), 219, Ulrich J. Duerst, *Kulturhistorische Studien zur Schweizerischen Rindviehzucht* (Bern: Bümplitz: Ben-teli, 1923), 17.
- 34 Since the second half of the seventeenth century Dutch settlers were recruited to cultivate the swampland in Brandenburg and set up dairies for the personal use of a number of German noblemen. See Jan Peters, Hartmut Harnisch, and Lieselotte Enders, *Markische Bauerntagebücher des 18 und 19 Jahrhunderts, Selbstzeugnisse von Milchbauern aus Neuholand* (Weimar: Bohlau, 1989).
- 35 See J. Hansen, *Lehrbuch der Rinderzucht Des Rindes Körperbau, Schlage, Züchtung, Fütterung und Nutzung* (Berlin: Parey, 1921), 9.
- 36 Meitzen, *Boden*, vol. II, 484.
- 37 See Franz Rasch, *Das westpreussische Rind*, Monographien landwirtschaftlicher Nutztiere, vol. II (Leipzig: Richard Carl Schmidt, 1904), 15.
- 38 See Matthias Weishaupt, "Viehveredelung" und "Rassenzucht Die Anfänge der appenzelischen Viehschauen im 19. Jahrhundert," in Fuchs, *Appenzeller*, 15. For the importing of Simmentaler cows into south Germany, see Richard Krzymowski, *Geschichte der deutschen Landwirtschaft unter besonderer Berücksichtigung der technischen Entwicklung der Landwirtschaft bis zum Ausbruch des 2. Weltkrieges*, 3rd ed. (Berlin: Duncker and Humblot, 1961), 340–341.

- 39 Quoted in Jon Mathieu, 'Agrarintensivierung bei beschränktem Umweltpotential der Alpenraum vom 16 bis 19 Jahrhundert,' in *Zeitschrift für Agrargeschichte und Agrarsoziologie*, 44 (1996) 139-140
- 40 Meitzen *Boden*, vol II, 484
- 41 Albrecht Thaer, ed., *Johann Christian Bergen's Anleitung zur Viehzucht oder vielmehr zum Futtergewachsbau und zur Stallfütterung des Rindviehes*, mit Anmerkungen, Besichtigungen und Zusätzen neu herausgegeben von Albrecht Thaer (Berlin Realschulbuchhandlung 1800), 477 (first published in 1780)
- 42 Johannes Nepomuk von Schwerz, *Beschreibung der Landwirthschaft von Westfalen und Rheinpreussen*, 2 vols (Stuttgart Hoffmansche Verlagsbuchhandlung, 1836-37), vol II, 143
- 43 A collection of quotations from 1840 to 1900 can be found in Ulrich Duerst, *Grundlagen der Rinderzucht Eine Darstellung der wichtigsten für die Entwicklung der Leistungen und der Korperformen des Rindes ursächlichen, physiologisch-anatomischen, zoologisch-palaontologischen, entwicklungsmechanischen und kulturhistorischen Tatsachen und Lehren* (Berlin Springer, 1931), 123-125 See also Hansen, *Lehrbuch*, 10, McMurry, *Transforming*, 17-18
- 44 Quoted in McMurry, *Transforming*, 20
- 45 The extensive agricultural reforms of the late eighteenth century, motivated by the desire to make farm production more efficient, took place all over Europe. However, for political reasons, reforms took very different directions in the old dairy zones. Denmark, for example, was helplessly caught in the conflict between Napoleon and the rest of Europe. And the loss of Norway in 1814 meant that the former dual monarchy, which geographically had stretched from the North Cape to the Elbe, was reduced to Denmark itself and the German duchies. Until the Danish-Prussian war in 1864 almost a third of the nation's greenland area was German. Holstein and Lauenburg belonged to the German Confederation, while Schleswig was nationally divided. Shortly after the loss of the German speaking population and area in the war with Prussia the Danish parliament passed several regulations to promote a large scale shift from the cultivation of plants to livestock farming. See Steen Bo Frandsen, *Danemark—der kleine Nachbar im Norden Aspekte der deutsch-dänischen Beziehungen im 19 und 20 Jahrhundert* (Darmstadt Wissenschaftliche Buchgesellschaft, 1994)
- 46 Livestock farming was embedded in a complex regional and local division of labor. See Rudolf Braun, *Das ausgehende Ancien Regime in der Schweiz Aufriß einer Sozial und Wirtschaftsgeschichte des 18 Jahrhunderts* (Gottungen/Zürich Vandenhoeck and Ruprecht, 1984), 58-69
- 47 See Duerst, *Kulturhistorische*, 21-23. For the canton of Glarus, see Jost Hosli, *Glarner Land und Alpwirtschaft im Vergangenen und Gegenwärtigen* (Glarus Kommissionsverlag Tschudi, 1948), 43
- 48 See Duerst, *Kulturhistorische*, 22
- 49 Within the Swiss livestock farming regions specializing in fodder production, which occurred as early as the late Middle Ages, was quite popular. This meant that farmers largely did not own cattle but instead rented out and leased farmstead meadows or Alpine meadows and sold hay fodder (particularly in the winter). Examples of feeding contracts from the seventeenth and eighteenth centuries can be found in Rudolf J. Ramseyer, *Das alte bernische Kuhewesen*, 2nd ed (Bern/Stuttgart Haupt, 1991), 46-49
- 50 Duerst, *Kulturhistorische*, 22
- 51 See Weishaupt, "Viehveredelung," 19-20
- 52 Quoted in Weishaupt, "Viehveredelung," 37. In Germany the first cattle exhibitions with nationwide relevance took place in 1863 in Hamburg, 1868 in Mannheim, 1874 in Bremen
- 53 For Germany see H. v. Falck, et al., *Die Milchproduktion Die Milchviehzucht Fütterung, Haltung und Pflege der Milchtiere Entstehung, Gewinnung und Behandlung der Milch*, Handbuch der Milchwirtschaft, vol 1, part 2, ed Willi Winkler (Wien Springer, 1930), 73-74
- 54 Rudolf Schatzmann, *Die Milchfrage vor der gemeinnützigen Gesellschaft des Kantons Bern*, 1872, quoted in Isabel Kollreuther, *Milchgeschichten Bedeutungen der Milch in der Schweiz zwischen 1870 und 1930* (unpublished Lic. Phil., Basel, 2001), 22
- 55 See Guy P. Marchal and A. Mattioli, eds., *Erfundene Schweiz Konstruktionen nationaler Identität* (Zürich Chronos, 1992)
- 56 A discussion of this question in retrospect can be found in A. Schmid, *Rassenkunde des Rindes*, vol 1, Rassenbeschreibung (Bern Benteli, 1942), 22

- 57 If the focus was on butter and particularly marketable cheese, then, conversely, farmers decided against extensive cattle farming. All types of production were governed by the dictum that the use of the limited land resources had to be coordinated depending on the season.
- 58 Likewise in other regions when the German Society for Agriculture (*Deutsche Landwirtschaftsgesellschaft*) organized its own cattle exhibition in 1887 for the first time, one of the organizers worried about the diversity of the German races. Only Bavaria counted twenty-eight cattle stocks at this time. During the next thirty years they were reduced to twelve, in the year 1903 the society found ten, in the year 1925 eight and in 1948 today's four 'Fleckvieh,' 'Frankenvieh,' 'Braunvieh' and 'Pinzgauer.' See Hans Oskar Diener, 'Forderung der deutschen Haustierzucht und der tierischen Produktion im 19. und 20. Jahrhundert durch staatliche Maßnahmen,' in *Bayerisches landwirtschaftliches Jahrbuch* 57 (1980), 78-120, quote from 79.
- 59 See Wilhelm Zorn, *Rinderzucht*, 2nd ed (Stuttgart Steiner, 1944), 32. In 1901 the Schleswig-Holstein association of breeding organizations for black and white breeds comprised fifteen local breeding associations, the Schleswig-Holstein association of breeding organizations for red-colored Holsteins united in 1898, creating thirty-one local breeding organizations. There were also Shorthorn/Angus and Angler associations. See Gustav Comberg, *Die deutsche Tierzucht im 19. und 20. Jahrhundert* (Stuttgart Ulmer, 1984), 264-267.
- 60 Hansen *Lehrbuch*, 144-402.
- 61 Comberg, *Tierzucht*, 247.
- 62 W. Janke, A. Körte, and G. von Schmidt, *Jahrbuch der Deutschen Viehzucht nebst Stammbuch deutscher Zuchtherden*, vol 1-7 (Breslau n.p., 1864-1872).
- 63 A detailed analysis of old terms of qualification can be found in Hans Ulrich Rubel, *Viehzucht im Oberwallis. Sachkunde Terminologie Sprachgeographie*, Beiträge zur Schweiz-erdeutschen Mundartforschung Bd II (Frauenfeld Huber, 1950).
- 64 McMurry, *Transforming* 22.
- 65 See Comberg, *Tierzucht*.
- 66 See Eugster, 'Zur Geschichte,' 220-221.
- 67 M. Strebel, *Das Freiburger Rindvieh* (Freiburg Frangniere, 1893), 16.
- 68 Weishaupt, *Viehveredelung* '38.
- 69 Several instruments have been developed for the process of measurement. See Max B. Pressler, *Neue Viehmesskunst*, 3rd ed (Leipzig n.p., 1886) [first published, 1854].
- 70 See for example, Oscar Knispel, *Anleitung für Züchtervereinigungen zur ordnungsgemässen Führung der Zuchtregister* (Berlin Deutsche Landwirtschaft-Ges., 1914).
- 71 Visual representation in the form of paintings, prints, and photographs provided forms to which other breeders could aspire. Such representations made it obvious to anyone that formal breeds were a reality. Moreover, stories about prize winners could be popularized much longer than the event lasted. Thus, livestock portraits were not only important in the establishment of a breed, but in its maintenance and improvement. For more details, see Hansen, *Lehrbuch*, 471-474.
- 72 Until then, problems of breeding had been at best part of training for veterinary students, in Munich for example. See <http://www.vetmed.uni-muenchen.de/mfo/geschichte.html>
- 73 Until 1884 Dutch breeders increased cattle exports throughout northern Europe so dramatically that farmers in the Netherlands faced problems with their offspring. See J. Hansen and A. Hermes, *Die Rindviehzucht im In- und Auslande*, vol 2 (Leipzig Richard Carl Schmidt, 1905), 47.
- 74 Clarence H. Eckles, *Dairy Cattle and Milk Production* (New York Macmillan, 1924) 98.
- 75 Eckles, *Dairy Cattle*, 29.
- 76 Several other controversial questions are outlined in Adolf Kraemer, *Das schönste Rind. Anleitung zur Beurteilung der Körperbeschaffenheit des Rindviehs nach wissenschaftlichen und praktischen Gesichtspunkten*, 3rd renewed ed (Berlin Parey, 1912).
- 77 Emil Port, *Der Formalismus in der landwirtschaftlichen Tierzucht* (Stuttgart Ulmer, 1899), 17.
- 78 *Tierzuchtungslehre*, Ein Gemeinschaftswerk zusammengestellt und herausgegeben von Wilhelm Zorn (Stuttgart Ulmer 1958), 63.
- 79 Charles Darwin, *The Variation of Animals and Plants Under Domestication* (London John Murray, 1868), vol II, Ch 24-26.
- 80 I have purposely left out other methods of breeding here because they were used in general.
- 81 Falck et al., *Milchproduktion*, 76.

- 82 On this entire paragraph see Jürgen Hansen *Zeitfragen auf dem Gebiet des Kontrollvere
swesens* (Berlin n p , 1923), Falck et al , *Milchproduktion*, 76-81
- 83 For decades Denmark had been one of the leading butter exporters in Europe See Frand
sen *Danemark*
- 84 Falck et al , *Milchproduktion*, 78-79
- 85 Since 1920 the calculation of premiums had been based on performance
- 86 The result was a remarkable rise in testing In the year 1937, 67.4 percent of all German
cows were tested, in some districts it was about 90 percent and more See Comberg,
Tierzucht, 353