The Dairy Cow and our Responsibility to Domesticated Animals

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In contrast to the other animals you have learned about in this book, the dairy cow is a domesticated animal, one whose past, present, and future—down into the core of its biological makeup—are directly and inextricably connected with human activity. Through thousands of years of interchange we have become part of a cow's being, and she part of ours in a way that goes beyond the connection we have with wild animals. Cows are deeply dependent on us and we on them. This bond makes the question of what responsibility we have to cows (and to all domesticated animals) loom large. How do we view this relationship, and how does that view guide our intentions in the way we breed and treat these animals? Do we see cows as beings who serve us and for whom we respectfully care? Do we see them as units of production whose efficiency we need to maximize? Do we manipulate them as bioreactors to produce substances we desire? You can find all of these perspectives expressed today, and they all have consequences.

Figure 1. A grazing dairy cow from Hawthorne Valley Farm, Ghent, NY.

Out of the Life of the Dairy Cow

Cows are grazers, like their wild cousins the bison. If they are allowed to live a life that corresponds to their nature, they live on pastures—in the midst of the food they eat—grazing on grasses and wildflowers. The cow lowers her head to the ground and touches the plants with the front end of her soft, moist snout. She does not chomp off the plants with her teeth. In fact, the cow (like the bison, giraffe, and other ruminants) has no top incisors or canines. She has, instead, a tough fibrous dental pad at the front of the hard palate. When feeding, the cow reaches out with her rough, muscular tongue, enwraps the plants, and tears them off while slightly throwing her head upward and to the side. She clearly needs to use her tongue for feeding—cattle that receive soft, fiber-poor feed begin to lick their fellow cows much more than usual to compensate for the lack of interaction with the tough, fibrous grasses and forbs. The cow needs this interaction to remain healthy.

Taking about one bite per second, the cow moves slowly through the pasture. Large glands secrete saliva while she grazes, and after taking many bites she swallows the now moistened mass of food. She can continue grazing in a kind of flowing rhythmic persistence for a couple of hours at a time. Cows on the pasture usually have a number of such feeding periods during the 24-hour-day, spending about one-third of the total day grazing. When swallowed, the food reaches the rumen, the huge first chamber of the four-chambered stomach. Occupying the entire left side of the abdominal cavity, the rumen can hold up to 45 gallons of fluid and feed. The muscular rumen massages the food in regular contractions—about one to two per minute is a sign of a healthy cow. It is only when a calf begins to feed on grass that the rumen completes its development and becomes fully functional. You could say that grass is the environmental half of the rumen and that the cow's anatomy and physiology only become whole through the activities of feeding and digestion.

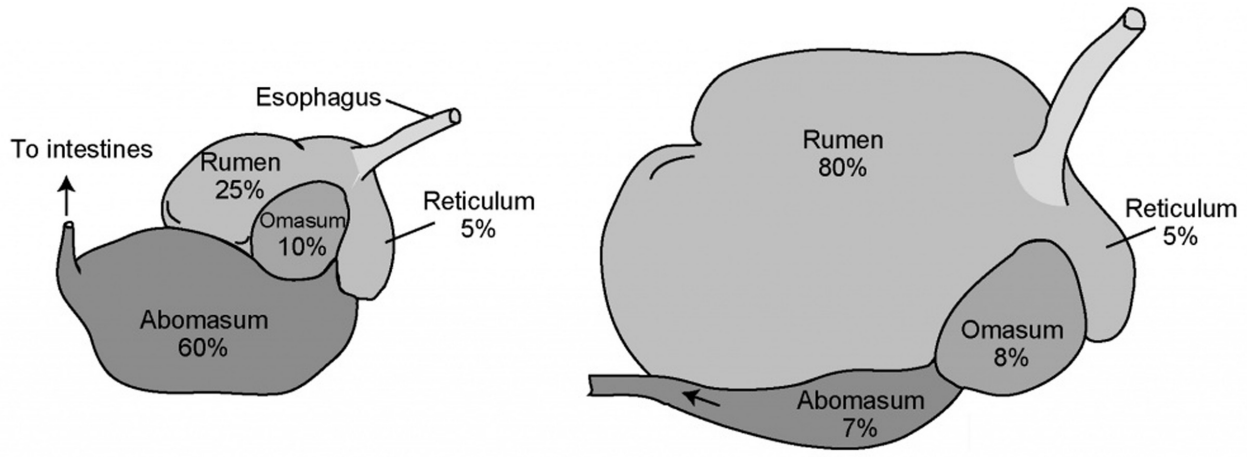

Figure 2. A schematic drawing of the development of the cow's four-chambered stomach. Only after a calf has begun feeding on grass does the rumen develop fully in size and function.

In the rumen, forage churns around in the fluid of the saliva and any water the cow has drunk. The rumen itself does not secrete digestive juices. When it is about half full, a wad of partially digested forage (what we call the cud) is regurgitated back into the mouth. If you are watching, you can see a bulge rapidly course up the cow's neck. When the cud reaches the mouth, the cow begins to ruminate. She grinds the food between her large cheek teeth in rhythmical, circling motions of the lower jaw. She chews a cud

about 50 to 60 times before swallowing it. Soon thereafter another cud travels up the throat, and rumination continues. The saliva glands secrete copious amounts of saliva while the cow is feeding and ruminating—up to 50 gallons a day. Yes, that's right: 50 gallons.[1] The drier the feed (for example, hay), the more saliva a cow secretes, and the greater the amount of water she drinks.

Cows usually lie on the ground while ruminating, often with drooping or fully closed eyelids. If you are ever in a hectic state of mind and find yourself driving through the countryside and have the luck to spot a herd of cattle lying on the ground—I know, not too likely a scenario—stop and spend a half hour attending to the herd. Expand out into it. You'll calm down. As they lie quietly on the pasture, their activity focused inward on grinding and digestion, the cows radiate centeredness and quietude. For the total of eight or so hours of rumination per day, it is as though the mixing, breaking down, exchanging, and building up of substances is telling the cow an intricate and enchanting story that she is intently listening to.

Figure 3. Dairy cows ruminating; Hawthorne Valley Farm, Ghent, NY.

As with bison and other ruminants, digestion in the rumen is facilitated by microorganisms that break down cellulose, the main, hard-to-digest component of fresh forage and hay. The forage is churned around, and it takes a few days for it to fragment into ever-smaller particles and to be broken down biochemically by the microorganisms. During this process nutritious fatty acids are released and absorbed through the rumen wall into the bloodstream. Since saliva is alkaline, it serves as a buffer and prevents the environment of the rumen from becoming too acidic. In an acidic environment, the microorganisms could not thrive.

Digestion is such a central part of the cow's life that even the animal's head plays a major role in breaking down the forage, through copious salivation and about 40,000 grinding motions a day in grazing. As biologist E. M. Kranich suggests, you can consider the cow's mouth functionally as a fifth chamber of the stomach.[2] After the mouth, digestion then continues in the microbial realm of the rumen. From there, the partially digested food moves into the other three chambers of the stomach, which continue the process of transformation. Only the last chamber (the abomasum) is comparable to our stomach. It secretes hydrochloric acid that kills bacteria, and digestive juices that break down proteins. As if the mouth and four stomach chambers had not done enough, digestion continues in the approximately 130-foot (40-meter)-long coils of the small intestine. (That's about 20 times the length of the animal!) After the cow has broken down the substances as far as possible and absorbed the many nutrients into the bloodstream, the large amounts of fluid that have been secreted as saliva and digestive juices are also reabsorbed, mainly in the last part of the digestive tract, the large intestine.

What has been digested and reabsorbed in the gastrointestinal tract enters the blood. The blood has the unique feature of being a fluid organ that connects all organs of the body by flowing through them. It gives over substances to the organs and receives substances from them. We need to imagine the blood as changing at every moment along its pathway. In every part of the body the blood is distinct inasmuch as it is responding to what comes from the organs and what they need. And yet in all this transformation, it remains a coherent flowing organ. Through this mediating activity of the blood, what the process of digestion brings forth allows the animal to continually recreate itself.

But that is not all. Through digestion, substances arise that the cow does not incorporate into her own organism, but rather gives off into the larger world. At the front end, she exhales with every breath—as all animals do—moist, warm air that is richer in carbon dioxide than the air she inhaled. And cows also burp frequently, in the process giving off methane-rich air that has arisen through ruminal fermentation. At the back end, she releases large amounts of urine and dung into the environment. A dairy cow weighing about 1,000 pounds will excrete a total of 80 pounds of urine and dung per day.

In contrast to the solid dung of other ruminants like sheep or goats, cows have fluid dung. The cow's large intestine does not absorb as much water out of what has been digested. In fact, we could say that from her moist snout, through all the secretions in her digestive tract, and finally in her dung, the cow embodies fluidity more than other ruminants—in a sense a paradox for such a large, heavy-boned and stout animal. The solid bones support a massive body and in the blood and the voluminous inner spaces of the digestive organs, continual and intense transformation occurs in the medium of fluids.

A most special fluid gift that the cow creates is milk. It provides just that nourishment her offspring need. And through domestication and husbandry, she creates more milk that we use for our consumption. Fill a glass with milk and place next to it a glass with grass in it. Two wholly different substances. The cow transforms the dry, fibrous grass into a nutritious creamy fluid. This demands intense activity on the part of the whole physiology of the cow. Breaking down and digesting grass already places high demands on the body. For example, for every quart of saliva the cow creates, 300 quarts of blood pass through the salivary glands. The other digestive organs are sustained by a similarly strong circulation.

The intense transformation of substances and secretion of fluids characterizing the digestive process are heightened in the formation and secretion of milk. For every quart of milk, three to five hundred quarts of blood pass through the udder. The udder receives from the blood—and that means from the rest of the whole animal—the substances it needs for its mammary glands to create milk. Fine membranes separate blood and mammary glands. On the one side flows nutrient-rich blood, giving over proteins, water, fats, and carbohydrates to the mammary glands. And on the other side of the membranes the glands fashion

and secrete a creamy white fluid. It is hard not to be in awe of the cow's ability to transform substances in its quiet and steady way.

For modern consumers, milk is a packaged good that we find in the refrigerated section of a store. We probably have learned that this milk comes from cows, but many children growing up in an urban environment will never have seen a cow. We probably don't know what kind of dairy farm the milk came from or how the animals were fed and treated. If, by circumstance or study, we do know something about these things, then we have begun, at least in our minds, to free the milk from its status as an isolated product for consumption. We can see it as an expression of a whole nexus of processes. The generation of milk stands as the result of the cow's interaction with her peripheral half—with pasture, soil, sun, weather, and of course with her human handlers. Which brings us to domestication.

Domestication

There is much "darkness which shrouds the original achievement" of domestication in animals and plants.[3] In the Near East around 11,500 years ago, it appears that human beings were collecting and perhaps planting wild plants, and herding wild animals.[4] The wild, long-horned aurochs (*Bos primigenius*, also called urus), a large animal standing six feet high at the shoulders, lived in that region. It inhabited vast areas of Europe and Asia, and was hunted to extinction in the seventeenth century.

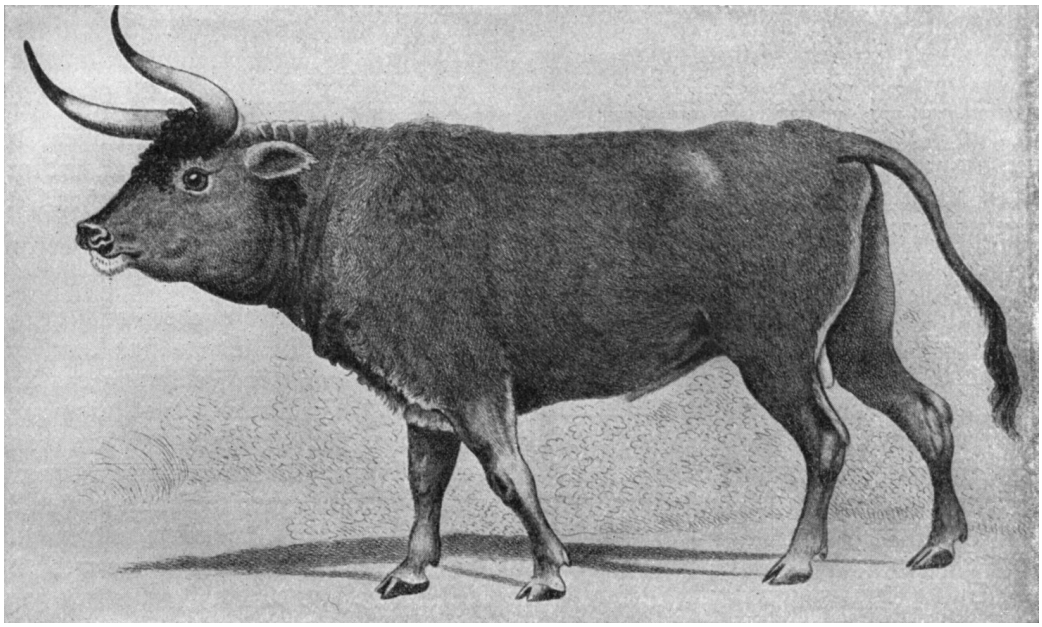

Figure 4. The extinct aurochs (*Bos primigenius*); drawing based on a sixteenth-century painting. (https://commons.wikimedia.org/wiki/File:Ur-painting.jpg)

Despite its formidable size, people in ancient Mesopotamia evidently herded the aurochs. Over time, their physical, physiological, and behavioral characteristics diverged from those of the wild aurochs. They became domesticated. How this actually occurred is what remains shrouded in darkness, but by around 10,000 years ago in the Middle Euphrates and Tigris valleys of Mesopotamia, physically distinct domesticated cattle had arisen—and they were considerably smaller animals than their wild progenitors.[5]

Herding and domestication initiated a new and intimate connectedness of the life of human beings and animals. We changed the animals—adapting them to our needs—and we in turn adapted to their needs. Domestication and the development of animal husbandry practices and breeding represent a coevolution of human being and animal.

What is all too easy to overlook is that the relation of the ancient peoples to animals always also encompassed a spiritual dimension. The ancient domesticators were not examining and breeding plants and animals with the utilitarian mind of a modern breeder. Nor were they half-rational tinkerers who somehow hit upon ways to domesticate animals in order to eke out a living (an all too common image of "primitive" peoples and "cavemen").[6]

In the ancient Middle East, the cow and the bull were connected with goddesses and gods. The Egyptian goddess Hathor, for example, was often depicted as a cow or as a woman with horns resembling those of the aurochs. Horns were an especially revered part of the animal. They were a sign of vigor, power, beauty, health—and the divine in the world. Domesticated animals (and plants) were venerated because it seemed clear to the people of those cultures that the animals embodied the divine, and the divine worked in and through them. Animal sacrifices to the gods and the gift of milk to the gods need to be seen in this light—they strengthened the connection to the divine. Domestication was one feature of the effort to intensify the union with the divine. It was not motivated simply by economic concerns.[7]

During the thousands of years that traditional pastoral and farming cultures coevolved with animals and plants, the demanding day-to-day interactions did not stand alone as "a job." The work was surely hard, but it was infused with reverence and enhanced by rituals and periodic festivals to give thanks and to celebrate life. The life and work with animals was embedded in a larger cultural and spiritual context that gave rich meaning to both the human deeds and the animal beings.

Figure 5. The Egyptian goddess Hathor depicted as a cow; from the Temple of Thutmosis II in Deir el-Bahary, Egypt. (Photo by Henry Edouard Naville, 1907; Wikimedia Commons)

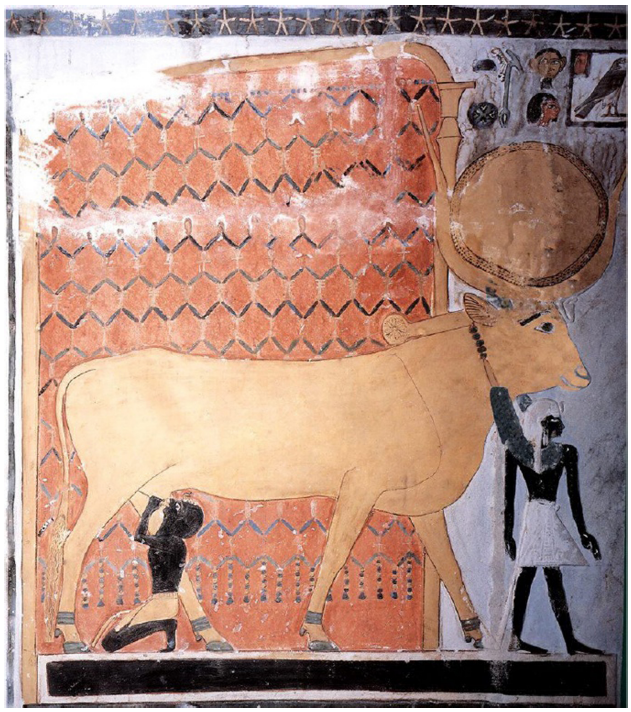

Figure 6. King Thutmose III as boy suckling from the goddess Hathor, depicted as a cow. (Egyptian Museum, Cairo)

In the course of domestication of cattle, a large number of breeds arose around the world. Currently you can find lists naming 800 cattle breeds, about 220 of which are listed as dairy cattle.[8] Many of the older, traditional breeds were raised for meat and dairy, and may have also served as draft animals. The breeds differ in size, shape, temperament, and many other features. This wealth of variety—which was not present in the wild progenitors—has been brought to appearance by the ongoing and intimate human-animal interaction. It is therefore not surprising that Charles Darwin could draw on domestication as an exemplar for evolutionary change—for the development of new varieties of animals and plants.

In this evolutionary process, the domestic plants and animals have become dependent upon human beings. We have brought them into the circle of our lives. In the process they lose some characteristics of their wild relatives and gain new ones that strengthen the connection with humans.[9] Domestic animals are open to human beings interacting with them; they do not flee. They are more submissive and amenable to living in corrals and confined quarters. They also lose some of their vigilance in noticing and avoiding predators. Such characteristics are also seen in young wild animals, so some of the changes that have occurred through domestication can be viewed as the retention of juvenile characteristics in adult animals. Such retention can also be found in the body, for example in the relatively short jaw or in the greater deposition of fat under the skin and in the muscles.

Domestication has led to a number of childlike (paedomorphic) characteristics in the animals so that they are open to and in need of day-to-day tending. But in contrast to a human parent-child relation, with domestic animals the responsibility of close, day-to-day tending never ceases throughout the whole of the animal's life. There's not a point at which we can say to a cow, "Okay, go out and see what you can do on your own." Domesticated animals that do escape and survive (so-called feral animals) usually develop—as we could expect—in behavior, physiology, and even in morphology, characteristics resembling those of wild animals. If they survive, they re-wild.

Each domestic animal has evolved characteristics that we desire and make use of, be they milk, meat, wool, or eggs. Inasmuch as breeders focus on achieving specific characteristics (leaner meat, more milk, etc.), the animal and its life become increasingly one-sided, as the recent history of dairy farming shows.

Ever More Milk

Until the twentieth century a cow gave about as much milk per day as her calf would have drunk—about a gallon per day in present-day breeds. In 2018, the milk production of high-milk-producing dairy cattle—mostly the Holstein breed—reached in the United States an average of nearly nine gallons per day.[10] This increase has taken place essentially since World War II.

A high-producing dairy cow today gives about five times as much milk as a cow at the end of World War II. And today, there are only about a third as many cows giving all the milk.[11] How has the remarkable increase been achieved? At the source lie the goals of achieving greater efficiency and productivity. These are ideas—motives—that come from human beings. The cow has become the medium for their realization.

There has been a single-minded focus on breeding and selecting cattle that produce ever-more milk. Which cows are the highest producers? Which bulls have offspring that produce more milk? A majority of dairy cows are artificially inseminated with the sperm of select bulls that have had the highest producing offspring.[12] Semen is sent around the country and the globe. Most dairy cows today are Holsteins (86 percent of all dairy cows in the United States).[13] They stem from a relatively small group of bulls. For example, one Holstein bull born in 1962 (named Chief) had a daughter that produced an unusually large vol-

ume of milk. Chief became a sought-after bull for mating, and in the end he fathered "16,000 daughters, 500,000 granddaughters, and more than 2 million great-granddaughters." His sons also became favored sires. As a result, the lineage of 14 percent of Holstein dairy cattle in the U.S. can be traced to Chief.[14]

In part, the increase in production has been achieved by selecting animals that were larger and therefore gave more milk. Holsteins are the largest dairy cows and the highest milk producers. Also, instead of milking twice a day, over half of the large dairy farms (with more than 500 cows) milk cows three times per day.[15]

Of course, if a cow grows larger, it needs to eat more to sustain itself and to produce more milk. Therefore, much effort has been put into finding a combination of feed that supports greater—more efficient, as one likes to say—milk production. Instead of being fed only fresh pasture forage or hay, especially high producing dairy cows are also fed concentrates, which can make up half or more of their food.[16] These concentrates are mixtures of grains (most often corn), soybeans, and other plant-based substances that are rich in protein, starch, fats, vitamins, and minerals and allow a cow to produce more milk than she otherwise could. One nutrient supplement that is fed to about a third of cows on large farms is blood meal from slaughtered animals—a source of protein and minerals, but not exactly what you would think a herbivore would naturally eat.[17]

Additionally, various humanmade "supplements" have been used to increase growth and milk production. For example, in the 1940s it was discovered that antibiotics not only kill bacteria in the gut but also increase growth in chickens and livestock.[18] So dairy farmers began including antibiotics in feed or water to stimulate growth. In 2013, over three-quarters of large dairy operations with more than 500 cows administered antibiotics prophylactically in feed or water to weaned or pregnant heifers (to promote growth or prevent disease).[19] Another, more recent, "supplement" is genetically engineered bovine growth hormone (so-called rBGH). Since the 1990s many conventional farmers inject their dairy cows with it to stimulate increased milk production.[20]

While all the breeding, feeding, and technological innovations (such as milking machines and milking parlors) have directly influenced increased milk production, it would likely have never gone so far had there not been support through government subsidies. Since the 1940s in the United States, overall consumption of milk products has risen with population growth, but in recent decades production each year has far surpassed the demand.[21]

This has been possible because since 1949 the federal government has been supporting the overproduction of dairy products through its milk-price-support program. From that time until the turn of this century the USDA "stood ready to buy as much butter, nonfat dry milk, and Cheddar cheese as manufacturers wanted to sell at specified support purchase prices."[22] While this automatic support system no longer exists in that form, it played a major role in encouraging overproduction for many decades. Today the government continues to provide subsidies to the dairy industry, and overproduction continues. In 2016 the government spent $20 million to buy up 11 million pounds of surplus cheese.[23] And as of May 2017:

> The U.S. has more than 800 million pounds of American cheese in reserve, the most since 1984, according to the USDA. The amount of butter in reserve totals 272 million pounds, the most since 1994. Some U.S. farmers are dumping millions of pounds of excess milk onto fields. In the Midwest and Northeast, nearly 78 million gallons of milk have been dumped so far this year, up 86% from the same period last year.[24]

Government subsidies directly support not only dairy farmers, but also farmers who grow crops such as corn and soybeans that are fed to cows. In the years between 1965 and 1990, for example, overall yearly payments by the government to farmers of all kinds averaged $10 billion per year.[25] When we buy inexpensive food, we need to realize that the price at the store does not include what we pay through our taxes.

The Larger Context

If you are a proponent of higher production, efficiency, specialization, intensification, and growth, then the dairy industry since the middle of the twentieth century is exemplary. The increase in milk production is a remarkable achievement when looked at in isolation—in isolation from the larger environmental, cultural and economic contexts, and in isolation from the fact that a cow is a living being and not a production machine.

The increase in milk production in the second half of the twentieth century was an integral feature of the industrialization and mechanization of agriculture that was supported by the government as I described above. Fewer cows produced more milk, and those cows were kept on ever bigger, highly mechanized dairy operations. According to USDA statistics, the historical maximum number of dairy cows in the United States. was reached in 1940—24.1 million cows. These cows were part of 4.6 million small family farms, virtually all of which had 30 or fewer cows.[26]

These were not "dairy farms" in the modern sense of a single-product farm. Most had some beef cattle, perhaps pigs and chickens, and they grew crops to feed their animals and themselves. On these family farms, cows usually had access to pasture during the growing season and were fed hay and silage during winter. Each cow was known to the farmer and was milked for many years.

All this changed radically in the coming decades. By the twenty-first century there were far fewer farms—in 2012, for example, only 64,000 dairy farms housed the 9.3 million dairy cows. Sixty percent of the animals were on only 5 percent of those farms, namely those with more than 500 cows.[27] These large farms focus only on milk production and have huge barns housing the cows. Operations with over 2,000 milking cows are no exception today, and each year they get bigger. On these farms, the cows are rarely or never set out on pasture to feed and freely move around. About 80 percent of all dairy cows in the U.S. today have no access to pasture while they are giving milk, which is most of the year.[28] They remain in barns or loafing sheds with little movement and no interaction with their peripheral half—the pasture.

It is perhaps not surprising that one-sided breeding for higher milk production, the provision of grain-rich feeds, the confinement of many animals in close quarters, the guiding mind-set that views animals as production units, along with an economic model that aims at efficiency, concentration, and more output, all set the stage for an array of problems for cows.

It has long been known that breeding and feeding for high milk production in cows living in confinement conditions affects the health and vitality of the animals.[29] The turnover of cows in a large dairy farm is significant—a fifth of the cows may be killed after their first lactation due to fertility issues, and, overall, such an operation may kill up to 40 percent of its cows every year. We should let this fact sink in. A typical Holstein today has two to three lactations in her life before she is killed—for a variety of reasons (less productivity, lameness, mastitis or other diseases). So an average high-producing Holstein will live only four to five years, while the life span of cattle in general is more like 20. (Just to note: beef cattle live even shorter lives—one to two years.) Without the demand to produce as much milk as possible in a short

period of time, a cow will reach its peak of milk production after three or four years of lactation and can continue healthy lactation for a number of years beyond that.

When you feed specialized animals food that deviates significantly from their natural diet, you challenge their digestive system and in turn their whole organism. When you feed cows high-grain concentrates, you feed them less forage, meaning less roughage and fiber. As a result, mixing motions in the rumen, burping, rumination and saliva flow all decrease. Acids resulting from the microbial fermentation in the rumen increase, leading to a more acidic environment.[30] This is called subacute ruminal acidosis and can have grave consequences, such as "feed intake depression, reduced fiber digestion, milk fat depression, diarrhea, laminitis [lameness], liver abscesses, increased production of bacterial endotoxin and inflammation characterized by increases in acute phase proteins."[31]

The inflammation of the udder—mastitis—is another common problem among high-producing cows.[32] Since it is an infectious disease, strict hygienic procedures help prevent bacteria from entering the udder via the openings in the teats. But this is only one side of the problem. Due to the intense circulation in the udder during lactation, the udder is susceptible to inflammation. (Increased circulation always occurs in inflamed organs—it calls forth the warmth and redness of inflamed tissue.) When milk production is increased to the utmost degree, the udder is almost on the verge of inflammation even without bacteria. The cow's physiology is stressed, her immune system taxed, and when bacteria do enter the udder, mastitis is likely.[33]

As I mentioned above, antibiotics are routinely added to feed and water of dairy cows before they start giving milk. They have a twofold function—to increase growth and to prophylactically protect against infectious diseases such as mastitis. These applications have led to an enormous use of antibiotics in dairy cattle (and also in pigs and chickens). About 80 percent of all antibiotics used in the United States are administered to livestock and chickens.[34]

In these non-clinical uses of antibiotics, smaller amounts are administered than in acute cases; as a result more bacteria survive and some become resistant to the antibiotics. Over the past decades bacteria have become resistant to virtually every antibiotic, causing a global crisis—not only for the treatment of animals with acute bacterial infections, but also for human beings, since therapeutic antibiotics for humans have also been used for animals, and resistance can be transferred from one type of bacterium to another. In the case of dairy cows, the resistant bacteria can spread in a variety of ways. Most resistant bacteria are found in manure, since only a portion of antibiotics is taken up by the cow's body, and the rest is excreted. The manure can find its way into streams and groundwater, contaminating them. Bacteria can also spread through milk—although, generally, pasteurization will kill most bacteria. Workers at dairy farms who handle the cows and manure can carry the bacteria out of the farm, just as can the meat of cows that have been slaughtered.[35]

The increased use of antibiotics to treat or prevent ailments became "necessary" because the animals have been kept in conditions that are decidedly unhealthy for them. Instead of changing those conditions, a technology is applied that itself leads to more problems, which then ripple out from the unhealthy centers of concentration into the broader environment. There is no way to keep the effects of the extreme conditions on a large dairy farm from impacting both the being of the cow and the larger world.

Horns and Tails

If you look into a large open barn housing dairy cows, you can notice that they have no horns and may well have only the upper part of their tails. This is not because they were born that way. It is because as

calves the developing buds of the horns were killed, most likely with a searing iron, and three-quarters of the tail was cut off.

This "disbudding" of dairy cows is so widespread today that many people don't realize that they are looking at animals whose ability to grow a part of their body has been truncated. Hornless cows have become the norm. And, in fact, in the province of British Columbia a legislative act encourages the dehorning of cattle (dairy and beef) and penalizes farmers or ranchers who raise horned cattle.[36] Tail docking, as it is called, became more widespread as dairy farms got bigger and more animals were confined in smaller spaces.

Both disbudding and tail docking cause the animal pain and are not trivial interventions—they are not comparable to clipping nails.[37] Although veterinarians recommend local anesthesia and analgesics to reduce pain, they are in fact rarely administered by American farmers.

So why do modern farmers want cows to be hornless and tailless? What would motivate them to submit their animals to painful procedures that result in them lacking two organs that they by nature possess and that are normally integral to the animal's life and behavior?

Horns are seen as dangerous. When you read about mainstream dairy farming, you will find statements such as this one in the *Journal of Dairy Science:*

> Handling and management of horned animals is deemed impractical for human and animal safety. Horned dairy cows pose a risk for stockpersons during routine management practices (milking, hoof trimming, calving) and veterinary examinations. Moreover, horned animals can cause injury to herdmates during aggressive interactions and competition at the feeding gate.[38]

What statements like these don't tend to mention is that the main problem arises because the dairy industry has chosen to house cows in close confines. In the case of free stalls and loafing barns cows move around, but because they are in a relatively small space, they do not have the freedom of movement they have on the pasture, where animals can easily give space to one another and retreat if needed. When hemmed in, cows get agitated and can be more aggressive, so it is not surprising that under such conditions cows with horns may hurt each other and their handlers.

The primary response to this human-created problem is to disbud the cows. As the authors of a review article entitled "To be or not to be horned—consequences in cattle" conclude, "Disbudding or dehorning are measures to adjust animals to husbandry conditions that are insufficiently adapted to the species-specific needs of cattle."[39]

And why tail docking? Proponents say it helps the cow stay cleaner and supports good hygiene, but none of the scientific studies that have been carried out support that view.[40] In the end it comes down to increasing the comfort of the handlers—they are no longer bothered by swishing tails. Once the tail has been amputated, a cow can no longer bat flies from her hindquarters. For a cow this means that more flies gather on her hind end and she has no means of removing them.[41]

Both horn disbudding and tail docking are surgical procedures through which farmers adapt cows to conditions humans have created, conditions that they feel warrant such interventions. They did not ask the cows, "How might we interact with you, so that you can live out your life in a species-appropriate way and at the same time you can serve us?"

This question reveals the central quandary that we can't avoid if we want to interact with domestic animals in a conscious and responsible way. I don't think there are any easy answers, any recipes or prescriptions for one right way to act or not act. But I do think we can make every effort to address the ques-

tion and the thorny issues it entangles us in. It is all too easy to sleepwalk through our interventions with domesticated animals.

We can begin by asking: Are horns and tails expendable organs? From a purely human-centric, utilitarian point of view, the answer is clearly yes. Cows can live without them and still produce milk. But what about the cow's point of view? This is where it gets hard. We can't ask the cow directly, but we can study the cow and try to understand how horns and tails are members of its whole being.

From an evolutionary perspective, tails and horns are integral members of the hooved mammals, to whom cattle belong. As I mentioned in earlier chapters, all horn-bearing mammals are ruminants with four-chambered stomachs, have paired hooves, and possess no incisors or canines in their top jaws. These —with other features—represent the particular coherence of this group of animals. You find this suite of characteristics in countless variations extending back into the deep history of mammalian evolution. The inner connection among hooves, horns, a four-chambered stomach, and the absent upper canines and incisors may not be transparent to us, but the fact of their long evolutionary co-development shows that they do have a connection even if we can't fathom it.

So horns are not "add-ons" to this large group of animals.[42] When paleontologists find fossils, the discovery of the bony cores of horns that emerge from the frontal bones of the skull is key in determining whether the animal is part of the bovid family, which includes, besides cattle, such animals as bison, Asian and African buffalo, wild sheep and goats, and the large variety of antelopes. The to-date oldest known bovid lived in the early Miocene period, about 18 million years ago.[43] And tails have been around even longer.

In the first months of its life, a calf begins to form the two horn buds. Initially these are not connected with the skull itself, but are free-floating in the skin above the skull. The buds then attach to the frontal bones of the skull. The horns have a bony core covered by what we see outwardly as the horn—a dense protein sheath called keratin (which is also the substance that makes up hair, hooves, and nails in mammals). The bony core does not remain solid; it becomes air-filled, and its inner surface is covered by a mucous membrane. The horn cavities are extensions of the large frontal sinuses, which connect through small passages with the nasal cavity.[44] Because these passages are narrow, air is exchanged between the nose and sinuses only slowly. Nonetheless, it is fascinating to realize that air penetrates all the way into the very core of the horns and that the air in the upper skull and horns communicates with the air that a cow breathes.

When calves are disbudded, the skull develops a different shape. The area at the back top of the skull —which would have been between the horns—rises up in the middle and becomes more pointed. Concomitantly, the skull does not grow as wide, showing that the horns play a role in the overall shaping of the skull during development.[45]

The horns are amply supplied with nerves and blood vessels and grow throughout the cow's life. Growth rings on the base of the horn sheath indicate how many lactations a cow has had. Although the outer sheath is not itself living tissue, the cow is very well aware of her horns and the extent of their reach. For example, a cow in a stall can access narrow feeding racks by tilting her head to come between the bars without touching them. And farmers report that a cow can with the tip of a horn deliberately open a closed feeding rack.[46] With her horns a cow scratches herself, and she can spar with other cows' horns. Horned cattle tend to keep a larger space between individuals, than do ones that have been dehorned, which may relate to a sense of larger body space that the horns mediate.[47]

So the horns are clearly not a meaningless appendage, nor is the tail. The tail is the extension of the vertebral column and consists of a series of ever-smaller vertebrae, muscle, nerves, and skin that at the tip grows long hairs. With this highly mobile organ the cow can effectively swat flies and pests that land on

the different parts of her hindquarters. It is also an expressive organ, although little do we fathom the variety of inner states the tail's movements may be giving voice to.

Diminishing the Animal

We can recognize that organs such as the horns and tail are integral to the life of the cow. But it is also a fact that the animals can live without horns or a tail. Since—as one might argue— we have already changed the animals considerably through breeding and animal husbandry practices, why not dock tails and remove horns, especially if we take measures to reduce pain and discomfort?

It is quite easy to follow the logic of this argument. It is inherent in many efforts to continue to alter animals in even more radical ways. Take, for example, an article in the journal *Neuroethics* entitled "Knocking Out Pain in Livestock: Can Technology Succeed Where Morality has Stalled?"[48] The author notes that factory-farmed livestock suffer from a variety of ailments that can cause pain. He assumes that with the increasing consumption of meat on the planet, factory farms will continue to be necessary. He does not consider that there are alternatives to factory farming. So, in his argument, if animals will continue to suffer under the factory farming conditions we have created, and we decide not to change those conditions, then the solution is to genetically engineer livestock so that they do not sense pain. There are indications that something like this works in mice, so maybe it would work in livestock. He presents this solution as a good way of addressing a critical animal-welfare issue.

The aim is to "help" animals by making them less-than-animals, by diminishing their animalness. This is a grotesque view. You recognize that you have created conditions that do not allow animals to flourish—that cause them pain and suffering and that alter fundamental characteristics—and then, instead of saying, "It's high time to change those conditions," you say to the animals, "Let's diminish your capacities so that you don't notice how bad off you are." Or as philosopher Marcus Schultz-Bergin puts it, in such a perspective you are blaming the victim, and "You could imagine us telling the animals 'if you were just not capable of suffering, then we would not have to make you suffer.' This seems quite perverse."[49]

Much of modern breeding and husbandry in service of industrial agriculture does in fact lead to diminishment and suffering on the part of animals. How could it be otherwise when we view and treat animals as commodities (things to be bought and sold), resources (things to be mined), and even as bioreactors (living factories to produce novel substances)? Since instrumental, utilitarian consciousness dominates the way animals are kept, bred, and treated, the animals themselves can have no voice. Once you have instrumentalized animals in your mind, then you can always find a justification for further manipulations that suit your agenda.

And once you have gotten used to viewing and treating animals in a particular way, you no longer realize what you are doing. When researchers surveyed 113 dairy farmers about their operations, the farmers usually stated that "they were treating their cows well, because they follow the recommendations of university and veterinary specialists."[50] But the researchers noticed that when the farmers spoke about the quality of the cow's life, they "seldom mentioned a cow preferring pasture." Their practices had become the norm, and they didn't have in mind what is integral to the species. As the researchers remarked, the farmers "often are not considering the view from the perspective of a cow."

Do domestication, breeding, and husbandry practices necessarily lead to "diminished" animals? Many years ago, I had a conversation with an environmental ethicist who was concerned about humanity perceiving and articulating the intrinsic value of other-than-human nature. Interestingly, he considered domesticated animals to be, in a sense, degenerate, since they are no longer capable of living in the wild. In

this view, breeding of animals leads in due course to their diminishment. While I can understand his perspective, I also could describe to him the childlike (paedomorphic) characteristics of domesticated animals I mentioned above, which in my view cannot be considered diminishment. Such characteristics form the basis of the close and evolving relation between human beings and domesticated animals. Through thousands of years these animals have become an integral part of our lives and we of theirs. Increasingly, we have dominated the interaction, while our dependence on domesticated animals has never ceased. The question is, can the weights on the balance shift? Can we give the animals a greater voice in our dealings with them?

Dairy Cows at Hawthorne Valley Farm

I live and work close to the 900-acre biodynamic Hawthorne Valley Farm in upstate New York that milks around 65 to 70 dairy cows. I know the farm quite well. My wife helped start its Community Supported Agriculture program (CSA), and we have been members ever since. I have been involved in the education program for the farm apprentices for more than a decade. And when my children were young, they spent many mornings in the barn helping with the cows.

This is no typical, single-purpose dairy operation. It has many different facets. The farm has its own dairy and the cows' milk is sold at the farm's store as raw milk, and is also made into cheese and yogurt that are marketed more broadly. The farm raises pigs and chickens. The CSA garden provides about 300 families with vegetables during the growing season and also offers families storage vegetables in the winter. A market garden sells vegetables at Green Markets in New York City. A farm store sells the farm's products, but is mainly a full-line natural food store selling mostly organic and many local products. The

Figure 7. Part of Hawthorne Valley Farm's dairy herd. Note the bull and a couple of calves in the foreground. A herd is only complete with cows, calves, and a bull.

farm has a learning center that serves hundreds of children each year; some come with their school classes and spend a week on the farm, others come to a variety of summer camps. Each year five to seven apprentices work and learn on the farm.

The farm operates under a nonprofit umbrella organization (the Hawthorne Valley Association) of which a number of other initiatives are a part. For example, a Farmscape Ecology Program seeks to "foster informed, active compassion for the ecological and cultural landscape of Columbia County, NY through participatory research and outreach"; and the Hawthorne Valley School is a K–12 Waldorf school located across the road from the farm buildings. (I taught biology at this school for nine years starting in the early 1990s.)

When you enter the valley, you often pass by the cow herd grazing or ruminating in a pasture. All the cows have horns. It is a mixed herd—mainly Brown Swiss with Jersey, Guernsey, and Ayrshire influences. A bull is always with the herd, and young calves roam playfully, nurse, and make their first attempts to graze. For about half the year (May through October), the cows are on pasture all day and night except when they are being milked. During the winter and early spring, when the grass isn't growing and the temperatures can be very low, the cows stay mainly in a large free-stall but always have access to the outdoors. They are fed hay and silage from the farm. They are not fed concentrates.

I spoke recently to the longtime farm manager, Steffen Schneider, and current farm manager, Spencer Fenniman, and asked them about their untypical husbandry practices. What motivates them? What are their challenges?

At the heart of biodynamic agriculture lies the intent to view and work with the farm as a kind of differentiated organism in which the manifold activities and beings support and enhance each other. The farmers strive to recognize the unique contributions of each of these aspects—such as the weather, topography, soil, compost, plants, animals, and human beings—and want to facilitate their interweaving to create a healthy farm and healthy products. The nonprofit Cornucopia Institute gave Hawthorne Valley Farm its highest rating ("beyond organic") for diverse, small-to-midsized dairy farms that emphasize pasture and forage-based feed.[51]

In respect to their dairy cows, Schneider and Fenniman emphasized that they would like to allow their cows as far as possible a free range of expression. That includes living in a herd, having horns, and being on pasture to the extent the climate allows. All this contributes to the health and well-being of the animals. For these farmers, the herd is especially important. If a new bull is brought into the herd, it joins as a calf, so that from a young age it is part of herd life. The bull mates with the cows on the pasture at will. When cows give birth to female calves, these calves stay with the herd and are raised to be dairy cows. In this way, family lines are maintained for many generations. The herd is integrated into the land and the husbandry practices, and it develops as a kind of extended organism through time.

As the farmers emphasized, each cow has its own temperament and unique characteristics. This makes the herd a place of dynamic interactions between individual cows of different age groups and dispositions. Sometimes a cow or bull that is too aggressive and doesn't meld with the rest of the herd is culled. In the social dynamics, each cow has its own social space, and the horns and the way she uses them are part of that social interweaving. I asked if there were many injuries—to cows or to farmers—because of the horns. The answer was, "Only when we make mistakes." In other words, as long as you know how cows use their horns and give them adequate conditions, injuries are rare.

A cow will be milked as long as she remains healthy and still produces adequate amounts of milk. Recently, a 19-year-old cow was retired that had been milked for 16 years! A vet described her a couple of years before as having "legs of a five-year-old cow." Now, this cow was an exception, but often cows at the farm will be milked until they are 10 years old (about seven lactations). Around this age, the milk pro-

duction often drops, but if it doesn't, a cow may be milked for some years more. In this way the farm gives the cows the possibility of living longer lives within the herd, which in turn affects the herd dynamics, since all age groups of cows are represented.

The farm does not breed cows for maximum milk production. Of course, the cows need to produce a fair amount of milk—milk that is well suited for drinking, but also for processing into yogurt and cheese. But the farmers consider even temperament and adaptability to be very important. The cows should thrive well in the herd and be amenable to diverse interactions with human beings—diverse milkers and handlers, and children who come and go. Recently the farm has begun introducing, via bulls, the Normande breed and Milking Shorthorns into the herd. The goal is to have a more multipurpose herd that produces both milk and good meat. While the farm presently sells meat from culled cows, they hope to improve the quality of the beef. The farm is currently raising some of the bull calves, which were previously always sold soon after birth.

Given the fact that the cows live a fuller cow life and are not pushed in only one direction, it is not surprising that they do not produce nearly as much milk per lactation as does a high-producing Holstein in a factory farm operation. While a Holstein that is milked two to three times a day may produce eight to nine gallons per day, a Hawthorne Valley cow milked twice per day gives around four gallons per day. A Holstein cow in a factory farm has on average only two to three lactations in her lifetime, giving large amounts of milk in her short life. In contrast, the Hawthorne Valley cows may have between six and ten lactations in their longer lives, and the total amount of milk they give in a lifetime may be less, but approaches that of the short-lived Holstein. Through this practice, the cows' physiology is much less stressed, and the farm has lower costs by raising animals that live longer.

The farmers see milk as a gift, and without the milk the farm could not survive economically. Surprisingly—at first hearing anyway—Schneider emphasizes that "in a holistic picture, in many senses, the manure is the primary gift that the cows give us." Manure is a key element in building soil fertility. On the one hand, cows leave urine and feces on the pasture, and, on the other hand, manure collected in the barns is mixed with straw, other plant matter, and food scraps from the store and school, then composted, and finally spread on the fields. On factory farms, manure has become a waste issue—the main task is often getting rid of it. On this farm, manure is a precious gift to be transformed and given back to build fertile soil.

Vegetable growth demands more from the soil than does pasture. As a result, the farm spreads about one-third of its compost on the vegetable fields, which make up only 2 percent of the agricultural land. As Schneider commented, "For every head of broccoli, you have to imagine a cow in the background…. I've not seen a study that shows you can practice sustainable farming without livestock to build soil fertility." So in this sense, the dairy cows are integral to growing vegetables for human consumption. And by utilizing manure and plant matter that come from the farm to create compost, the farm does not rely on nonrenewable fossil fuel products—artificial fertilizers—to promote plant growth.

Most small dairy farms are struggling, and many are closing. The price farmers receive for milk dropped markedly from 2014 to 2015 and has remained low ever since. Meanwhile, other costs continue to rise, so it is increasingly difficult to pay bills, and many farmers have large debt loads. The number of small dairy farms has been declining for decades. For example, in 2003 there were 70,000 in the United States; in 2017 there were 40,000. You only have to travel to the Midwest, where smaller farms of all kinds continue to disappear, to witness the demise of farming-based, small town culture.

Income from milk can often be less than it takes to produce the milk. To keep the farms going—and thanks to automation and to the cheap labor (often performed by undocumented workers)—farmers are commonly dependent on off-farm income earned by taking other jobs. This is the case in farming in gen-

eral, with the exception of the largest commercial farms. Off-farm income can make up half of the income of smaller farms.[52]

The dire situation is revealed in the increase in suicides among dairy farmers.[53] The Center for Disease Control found in a 2016 study that of all occupational categories, farming, fishing, and forestry have the highest rate of suicides—3.5 deaths per 1,000 individuals.[54]

At Hawthorne Valley, you have a different picture. It started as a small initiative in 1973 and has grown steadily over the past 45 years. With its variety of farming, commercial, and educational activities, it has attracted more and more people to this rural area of upstate New York. It is one example of numerous initiatives in the Hudson River Valley corridor that are helping to establish a regional foodshed. But what is clear is that the farms cannot exist on their own. They need communities, and they need to be integrated into innovative economic and cultural contexts.

Reflecting on especially the farm's dairy operation, Schneider said that "being embedded in what I call a micro food value chain is the only reason we are still in business." What he means is that the farm sells its milk—which is certified organic and biodynamic—to its own dairy at a premium price, and the farm's dairy adds value by turning the milk into yogurt and cheese. The raw milk is sold at the farm's store, as are yogurt and cheese. The latter are also sold at New York City Green Markets, and the yogurt finds its way into stores in many eastern states. By adding value and services, the farm receives significantly more income than it would if it sold its milk on the bulk-milk market.[55]

On this farm it is clear that the farmers strive to pay attention to the characteristics of the cow, recognize the cow as a living being, and work with the cow's needs and nature in designing the dairy farm. But you cannot do justice to the cows in isolation. The land, plants, other animals, and the human beings who visit and work on the farm all need to be taken into account. This entails the significant and yet inspiring challenge of working within the larger ecological, social, and economic contexts in innovative ways.

Taking Responsibility

It is both our gift and our burden as human beings that we can become conscious of the larger reality that we are a part of and that we affect through our actions or inactions. It is in this awareness that the feeling of responsibility and the desire to take responsibility can arise.

When we interact with cows—or any other part of the world—our actions leave an imprint. Because cows are domesticated animals, they bear the effects of human interactions that reach back for thousands of years. We are responsible for these interactions and their effects. When we speak of *taking* responsibility, we are pointing to a conscious undertaking, not something that just happens through tradition or directives from authorities. We know ourselves to be in a relationship, and we know that it is possible to act in better or worse ways. We may not know what to do; we may not know what it would mean to act truly responsibly, but we are not sleepwalking through the day as if our thoughts and actions did not matter.

Taking responsibility is no easy matter. As we have seen, the conventional farmers who stated that their cows are, from an animal welfare perspective, better off than they were two decades ago, are judging the well-being of their cows within the confines of the existing system of industrial agriculture. They cited, for example, improved nutrition (concentrate feed and additives), better veterinary care, better ventilation in barns, and free stalls in which the animals can move around. I give these farmers the benefit of the doubt that they believe this. What I don't know are the motives that led them to make these changes—whether they came out of concern for the cows, concern for profits, or pressure from outside groups, to name a few possibilities.

But it is striking what the interviewed farmers did not mention. They did not state that the cows had been dehorned and their tails docked, that they were typically slaughtered after only a few lactations due to the stresses of high milk production and a variety of ailments, and that they generally had no access to pasture.

The farmers viewed the cow's welfare from the perspective of improvements within the already existing industrial management system. They were thinking within that box. They had lost sight of what was not in that box—the cow as a horned, tailed, and grass-grazing animal. When they say that the cow has better nutrition today, they mean in terms of what the cow needs in order to survive (I won't say thrive) within the industrial model and continue to produce ever more milk.

When a cow is considered primarily in terms of production, its reality as a living being recedes into the background. There is then no need to be particularly concerned about removing horns or tails, if that serves the larger goals of management efficiency. And the idea of genetically engineering cows to feel no pain may call forth no scruples. This notion can seem a consistent and logical extension of the trajectory that has been followed for decades. What is the problem, proponents of such approaches may ask? How easy it is for the mind to become caught up in a particular worldview that provides the frame for what is deemed acceptable.

Conventional farmers are themselves entangled in a system they often feel they can't escape. They may feel they have no choices other than to continue within the status quo or to abandon farming altogether. These are, I believe, not their only alternatives. The example of Hawthorne Valley Farm shows one. But I also think that most of us know situations in life in which we feel caught and can see only a couple of bad alternatives.

So how is it possible to break out of a system, and what facilitates and motivates moving beyond a worldview that promotes that system? Of one thing I'm certain: there is no one answer to these questions, and there are no recipes.[56] Keeping that in mind, I'd like to describe one example of the process of breaking out of a system and a worldview into a broader, more encompassing outlook.

The 22-year-old Aldo Leopold was leading, in 1909, a crew for the newly formed United States Forest Service. The crew was carrying out an inventory of the locations, quantity, and quality of timber in Arizona and New Mexico. It was wild country, and there were still many wolves. As Leopold later wrote, "In those days we had never heard of passing up a chance to kill a wolf…. I thought that because fewer wolves meant more deer, that no wolves would mean hunters' paradise."[57] Wolves were widely considered vermin—pests to be gotten rid of. Leopold wholeheartedly accepted this view. In addition, he had hunted since an early age and was still, as he put it, "full of trigger-itch."[58]

When he and his crew noticed, from up on a rimrock, an older wolf and her pups emerging from a turbulent river below, they immediately began shooting. They then climbed down to the banks of the river and found the old wolf lying on the ground, still alive but unable to move. Before their eyes, the wolf died. Over thirty years later Leopold wrote, "We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes—something known only to her and to the mountain."[59]

As he watched the light in the wolf's eyes disappear, Leopold met the wolf for the first time. For a split second he glimpsed the wolf as a being in its own right. The impression stayed with him. In a sense, the wolf became part of Aldo Leopold on that day. And yet, it took a long time for the wolf to become a force in his thinking. The perception of the dying wolf was not enough. He needed to spend many years out on the land, where he observed the increasing effects of wolf eradication on the larger environment. "I have watched the face of many a newly wolfless mountain, and seen the south-facing slopes wrinkle with a maze of new deer trails. I have seen every edible bush and seedling browsed … to death."[60] He also

witnessed the effects of overgrazing cattle and sheep. As he remarked, "While a buck pulled down by wolves can be replaced in two or three years, a range pulled down by too many deer may fail of replacement in as many decades."[61]

Leopold was initially jolted by the experience of the dying wolf, and something opened up. Then he spent decades observing the manifold effects of wolf eradication. Gradually his worldview transformed. He broke through the boundaries of the notion that fewer wolves meant more deer meant great hunting. In the last decades of his life he worked to develop an ecological view of wildlife and worked tirelessly to protect wildlands. Toward the end of his life he formulated what he called a land ethic that "changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such."[62] His worldview had totally shifted—and the world that he perceived and incorporated into his thinking was much larger and more encompassing than the one he knew as a young man.

As it was with Leopold, it is not uncommon today that we wake up to our responsibility when we experience how human action has wrought havoc in the world. How often do we need to experience destruction of life—the killing of the wolf, the destruction of ecosystems—to realize the value of the life that has disappeared? We feel: that's not right and something needs to happen. This is an important realization, but it is not enough. We need to find understanding and ways of acting that bring healing.

It is clear that when we view cows as production units or wolves as vermin, we are considering them both in far too narrow terms and primarily from the perspective of our own gain. We have avoided considering much of the reality of the animal's life and the way it is woven into the larger world. So we can begin to take that larger fabric of life seriously and turn our attention toward it. We can learn how the cow (or the wolf) is a truly integrated organism with a very specific way of being. We can realize that the cow is a giver of gifts, as farmer Steffen Schneider put it—the gifts of milk and manure—and is a substantial presence from which the farmers and all the children and adults who participate in the farm's education programs can learn. Such a change in perspective motivates our finding ways of acting that are rooted in a growing understanding and respect for the beings we are interacting with and affecting.

A major problem today is how distant most of us are, in terms of our awareness, from the effects of our actions. Think of all the products we use and consume. When I buy an inexpensive gallon of milk in a grocery story, I am most likely supporting factory farming and the whole economic system and worldview that drive it. I am basically saying with my purchase, without realizing it, "Produce more milk this way." Through my deeds I am connected with, and influencing, what happens in the world, but I may be oblivious to this fact.

This disconnect between myself as a consumer and the gifts I am consuming, which come from the earth, plants, animals, and toils of other human beings, is one consequence of the division of labor and an increasingly global economy. I am separated by countless steps from the larger reality and origins of the milk I drink or the clothes I wear. At the same time, my dependency on this complex web of relations becomes ever stronger. If I become conscious of this dependency, then a sense of gratitude arises for all that is given by other beings to make my life possible. At the same time, I can ask: how are those other beings and the earth being treated?

It is perhaps in response to the increased distancing effects of technology and of our economic system that the desire to connect consciously arises. What can I do to become aware of what I, concretely, am supporting through all my purchases? What policies and regulations can enhance the quality of life for animals and workers? Such questions have led to the pursuit of myriad activities. Think of the many, often intertwined, movements: animal rights, fair trade products, organic and regenerative agriculture practices, localization and regionalization of food production and distribution, and local currencies, to name a

few. They all strive to consciously create connections that can allow all partners in the relations to thrive. There are many hurdles and no quick fixes. But the fact is that at the basis of these strivings lies a different way of knowing oneself embedded in the world.

Over two hundred years ago, Johann Gottfried Herder wrote, "The human being is the first to be set free in creation."[63] Animals are meaningfully woven into their contexts of life. (They do not pull back and start thinking about how they could make life better for themselves; they do not worry about whether they will make it through the coming winter or discuss strategies of how to do so.) When Herder said we are set free, he meant that we have become separate from the wise web of life inasmuch as we can ask questions, that we think about things as though from a distance, that we are uncertain about what the best ways to act may be, that we make many mistakes.

For the past centuries, Western culture—which is now present as a force around the globe—has thrived on trying to free itself from the bonds of nature. As a consequence, we have lost the wisdom that informs all life. We have banked on ingenuity. This only takes us so far, since smartness often leads to solutions that exploit or ignore the larger fabric of life on the planet. But we can turn for orientation toward the wisdom of life. That is also a gift of our being "set free."

Notes

1 Swenson 1990, p. 292. This volume contains much valuable information about cow digestion and physiology.

2 Kranich 1995, pp. 19–29.

3 Isaac 1962.

4 Zeder 2011.

5 Ajomone-Marsan et al. 2010; Bollongino et al. 2012.

6 See Chapter 5, "Evolving Consciousness," in Holdrege 2021.

7 Hahn 1896; Harlan 1998; Isaac 1962; Cauvin 2000; Russell 2011.

8 https://en.wikipedia.org/wiki/List_of_cattle_breeds

9 Gepts and Papa 200; Price 1984 and 1999; Zeder 2012.

10 See: https://www.nass.usda.gov/Charts_and_Maps/Milk_Production_and_Milk_Cows/cowrates.php and also http://www.holsteinusa.com/pdf/fact_sheet_cattle.pdf

11 In 1944, there were 25.6 million dairy cows in the U.S and each produced an average of 532 gallons of milk per year. In 2012, by contrast, there were only 9.3 million cows and each produced an average of 2,526 gallons of milk per year. Total milk production rose from 117 billion pounds in 1944 to from to 200.6 billion pounds in 2012 (https://nass.usda.gov/Publications/Trends_in_U.S._Agriculture/Livestock_and_Dairy/index.php; and https://www.agcensus.usda.gov/Publications/2012/).

12 U.S. Department of Agriculture 2009.

13 U.S. Department of Agriculture 2016.

14 https://www.ucdavis.edu/news/how-genetic-mutation-1-bull-caused-loss-half-million-calves-worldwide/ and http://www.newsweek.com/2016/11/25/dairy-cows-cattle-genetic-mutation-521152.html

15 U.S. Department of Agriculture 2016.

16 Krause and Oetzel 2006; National Research Council 2001.

[17] U.S. Department of Agriculture 2016.

[18] McKenna 2017.

[19] U.S. Department of Agriculture 2014b (see table G.1b., p. 149); U.S. Department of Agriculture 2017.

[20] Fulwider et al. 2008.

[21] "Overall, U.S. milk consumption on average is rising between 1 and 2 percent annually but production is going up around 3 percent." See: https://www.cnbc.com/2017/09/22/dairy-glut-in-us-leads-to-problem-of-spilled-milk.html

[22] http://ageconsearch.umn.edu/record/33612/files/ai010761.pdf

[23] https://www.usda.gov/media/press-releases/2016/08/23/usda-purchase-surplus-cheese-food-banks-and-families-need-continue

[24] https://www.marketwatch.com/story/got-milk-too-much-of-it-say-us-dairy-farmers-2017-05-21

[25] Gardner 2002, p. 220.

[26] In 1939 there were 21.9 million dairy cows in the U.S. on a total of 4,663,431 farms. 99% of the farms had 30 or fewer cows, while only 0.2% had 50 or more cows. The USDA census stopped listing size at "50 or more." http://usda.mannlib.cornell.edu/usda/AgCensusImages/1964/02/02/743/Table-15.pdf

[27] U.S. Department of Agriculture 2014a.

[28] U.S. Department of Agriculture 2016.

[29] Brickel and Wathes 2011; Espejo et al. 2006; Hadley et al. 2006; Hansen 2000; Hare et al. 2006; Knaus 2009; Lucy 2001; Oltenacu and Broom 2010; Walsh et al. 2011; Wathes 2012.

[30] Russell and Rychlik 2001.

[31] Plaizier et al. 2008.

[32] Walsh et al. 2011.

[33] Sordillo and Aitken 2009.

[34] Van Boeckel et al. 2015; U.S. Department of Agriculture 2016. Globally, 73 percent of all antibiotics sold are given to animals that are raised for food (Van Boeckel et al. 2019).

[35] Heuer et al. 2011; Marshall and Levy 2011.

[36] http://www.bclaws.ca/civix/document/id/consol14/consol14/96044_pit

[37] See Eicher et al. 2006; Humane Society of the United States 2012; Stafford and Mellor 2011.

[38] Gottardo et al. 2011.

[39] Knierim et al. 2015.

[40] Fulwider et al. 2008; Sutherland and Tucker 2011.

[41] Sutherland and Tucker 2011.The practice of tail docking in dairy cows may be on the way out in the U.S. Although still allowed at the federal level, it was forbidden in California in 2009. The American Veterinary Medical Association opposes routine docking of tails in dairy cows and the National Milk Producers Federation—whose members produce the bulk of milk in the U.S.—required members to begin phasing out routine tail docking at the beginning of 2017; (https://www.avma.org/KB/Resources/LiteratureReviews/Pages/Welfare-Implications-of-Tail-Docking-of-Cattle.aspx?PF=1; https://www.avma.org/KB/Policies/Pages/Tail-Docking-of-Cattle.aspx; http://www.nmpf.org/files/Tail%20-Docking%20Release%20TB%20102615.pdf).

[42] Riegner 1998; Schad 2020, chapters 7 and 8; Spengler Neff et al. 2016.

[43] Solounias et al. 1995.

[44] Sisson and Grossman 1953, p. 144; Nickel et al. 1986, p. 157.

[45] Probst et al. 2017.

[46] Knierim et al. 2015.

[47] Irrgang 2012.

[48] Shriver 2009.

[49] Schultz-Bergin 2017.

[50] Fulwider et al. 2008.

[51] https://www.cornucopia.org/scorecard/dairy/

[52] U.S. Department of Agriculture 2016.

[53] Kilgannon 2018.

[54] McIntosh et al. 2016.

[55] In October 2018, Hawthorne Valley Farm sold its premium raw milk to its dairy for .$42 per pound, while the wholesale price for conventional milk was only .$16 per pound.

[56] For other perspectives that emphasize animal sentience animals and call for transforming our relation to animals see, for example, Abram 2011; Bekoff 2002; Sloan 2015.

[57] Leopold 1987, pp. 129–30. The book was originally published in 1949.

[58] For a more comprehensive consideration of Leopold's encounter with the wolf and the subsequent transformation of his worldview, see Holdrege 2016.

[59] Leopold 1987, p. 130.

[60] Leopold 1987, p. 130.

[61] Leopold 1987, p. 131.

[62] Leopold 1987, p. 204.

[63] Herder 1982. This book was originally published in 1791; Herder lived from 1744 to 1803 and was a close friend of Goethe's.

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