July 2012

THE HUMANE SOCIETY OF THE UNITED STATES

An HSUS Report: The Welfare of Intensively Confined Animals in Battery Cages, Gestation Crates, and Veal Crates

Abstract

Within U.S. animal agriculture, the majority of egg-laying hens, pregnant sows, and calves raised for veal are reared in battery cages, gestation crates, and veal crates, respectively. The intensive confinement of these production systems severely impairs the animals' welfare, as they are unable to exercise, fully extend their limbs, or engage in many important natural behaviors. As a result of the severe restriction within these barren confinement systems, animals can experience significant and prolonged physical and psychological assaults. Indeed, extensive scientific evidence shows that intensively confined farm animals are frustrated, distressed, and suffering.

Introduction

Surveys of public opinion clearly indicate that Americans care for the welfare of animals raised for food.[1,2,3,4] This interest in the well-being of farm animals has grown as many aspects of U.S. production practices have become increasingly inhumane. Though certain corporate and industry trends[5,6,7,8,9,10,11,12] have begun to reflect Americans' desire for better treatment of farm animals, much of industrial agribusiness continues to view them as commodities, rather than sentient individuals capable of experiencing joy and frustration, pain and suffering.

Indeed, favoring productivity over welfare in U.S. agriculture has had major consequences for farm animals, yet some agribusiness proponents continue to equate the ability of animals to gain weight or lay eggs as indicative of good welfare.[13] With the genetic selection of rapid growth characteristics and high rates of lay for almost all breeds of commercially raised farm animals, these animals will reproduce and grow, as well as produce eggs, even when intensively confined and struggling with demonstrably compromised welfare. Throughout animal agriculture there are abundant examples where animals are highly productive, yet still suffer. For example, a laying hen will continue to draw calcium from her bones to make egg shells even though minerals are depleted to the point that her skeletal integrity is compromised, leaving her prone to bone fractures.[14] Cambridge University Professor of Animal Welfare Donald Broom asserts, "[E]fforts to achieve earlier and faster growth, greater production per individual, efficient feed conversion and partitioning, and increased prolificacy are the causes of some of the worst animal welfare problems."[15]

Equating productivity with good welfare is not a scientifically grounded theory. Productivity is often measured at the group level, which does not accurately reflect individual welfare. For example, if individual hens are crowded to the point that their individual rates of lay decline, the productivity of the entire house will still improve as there are more hens laying eggs.[16] Similarly, pigs may be crowded into a barn to the point that their individual growth and reproduction is reduced, yet the performance of the herd as a whole will increase.[17] According to Bernard Rollin, University Distinguished Professor of Philosophy, Physiology, and Animal Sciences at Colorado State University, "in industrial agriculture, this link between productivity and well-being is severed. When productivity as an economic metric is applied to the whole operation, the welfare of the individual animal is ignored."[18]

The breadth of scientific evidence demonstrating that intensively confined animals are frustrated, distressed, and suffering under modern production schemes is extensive,[19,20,21,22,23,24,25] conclusively substantiating that battery cages for egg-laying hens and crates for pregnant sows and calves are simply not appropriate environments.

All animals have behavioral needs, internally motivated behaviors that persist in any environment, akin to the need of migratory birds to migrate, for example.[26] Some behaviors are so important that animals will suffer either psychologically or physically if prevented from displaying them. Indeed, animals are strongly driven to perform such necessary, natural behaviors even after basic physiological requirements are met, such as the provision of food, water, and shelter.[27]

In the United States, the overwhelming majority of the nation's 283 million egg-laying hens[28] are reared in barren, wire battery cages so restrictive[29] that the birds cannot even spread their wings.[30] With no opportunity to exercise or engage in many other natural behaviors, these caged birds suffer immensely, as do intensively confined breeding sows and calves raised for veal. More than 5.8 million pigs are used for breeding in the U.S. pork industry,[31] and the majority[32,33] of breeding sows are confined in 0.6 m (2 ft) wide gestation crates, narrow enclosures that prohibit the pregnant animals from even turning around[34] for nearly the entirety of their approximately four-month (112-115 day)[35] pregnancies. Similarly, many calves raised for veal in the United States are severely restricted in individual crates,[36,37] unable to fully rotate their bodies or lie down comfortably in a natural position.[38,39,40]

The welfare of these intensively confined hens, sows, and calves is significantly impaired, as the animals are denied the ability to exercise, fully extend their limbs or simply turn their bodies, or perform integral, instinctual, natural behaviors.[41] The forced near-immobilization may take a serious physical and psychological toll, leading both to physiological problems and psychosis resulting from extreme boredom and frustration.[42]

As of 2012, barren battery cages are now illegal in the entire European Union,[43] as are gestation crates by 2013.[44] Veal crates were banned starting in 2007.[45] Domestically, Colorado,[46] Arizona,[47] Michigan,[48] and Maine[49] are requiring producers to phase out the use of gestation crates and veal crates, and Florida,[50] Oregon, [51] and Rhode Island[52] have similar measures phasing out gestation crates. California and Michigan are also phasing out the use of battery cages, in addition to gestation crates and veal crates.[53,54] In Ohio, there is a moratorium on the construction of new battery cage facilities, as well as a gradual phase out of gestation crates and veal crates.[55]

The Welfare of Laying Hens in Battery Cages*

Battery cages are small, barren wire enclosures. The most commonly used cages hold 5-10 birds.[56] A typical U.S. egg farm contains thousands of these cages at an average space allowance of just 432-555 cm^2 (67-86 in^2) per bird,[57] which affords each hen an amount of floor space smaller than a single sheet of letter-sized paper. These cages prevent the birds from fully performing the bulk of their natural behaviors, including nesting, perching, dust-bathing, scratching, foraging, exploring their environment, running, jumping, flying, stretching, wing-flapping, and even freely walking—natural behaviors replaced by inactivity or inappropriate substitutes on the barren cage floor. Additionally, the severe restriction of physical movement leads to poor foot condition[58] and metabolic disorders, including disuse osteoporosis[59] and liver damage.[60]

* For more information, see "An HSUS Report: The Welfare of Animals in the Egg Industry" at www.hsus.org/farm/resources/research/welfare/egg_industry.html, "An HSUS Report: Welfare Issues with Selective Breeding for Production in Egg-Laying Hens" at www.hsus.org/farm/resources/research/practices/selective_breeding_eggs.html, and "An HSUS Report: A Comparison of the Welfare of Hens in Battery Cages and Alternative Systems" by Drs. Shields and Duncan at www.hsus.org/farm/resources/research/practices/comparison_hen_welfare_cages_vs_cage_free.html.

Behavioral Deprivation

The central problem associated with the use of battery cage systems for housing laying hens is the severe restriction of movement and deprivation of opportunity to display important natural behaviors. The most well-documented behavioral need of the laying hen is to engage in nesting behavior, which is her requirement to seek out a secluded site in which to carefully scrape out and build a shallow nest on the ground. Nesting behavior is triggered internally by hormonal fluctuations associated with ovulation.[61] The internal, biological signals to perform nest-site selection and nesting behavior are always present, even in the restrictive confines of the battery cage, where natural stimuli are absent.[62] Studies have shown that hens are highly motivated to gain access to a nest site when they are about to lay an egg.[63] Ian Duncan, Emeritus Chair in Animal Welfare at the University of Guelph, contends that the most significant source of frustration for battery hens is "undoubtedly the lack of nesting opportunity."[64] According to Michael Baxter, Director of the Design Research Center at Brunel University, the thwarting of nesting behavior is likely to cause "significant suffering."[65] Decades of scientific studies suggest that hens are frustrated, distressed, and that they suffer in battery cages as there is no outlet for normal, internally triggered nesting behavior.[66,67,68,69,70]

Their inability to nest is just one of many behaviors prevented when laying hens are confined in battery cages. The enclosure's wire flooring deprives the birds of the opportunity to express normal foraging, scratching, and dustbathing behaviors. The natural urge to forage and scratch remains strong, despite the presence of a complete diet fed *ad libitum.* Studies have shown that hens will choose to forage for feed on the ground in loose substrate rather than eat identical food freely available in a feeder.[71,72] Dustbathing is also important to hens. Under naturalistic conditions, hens regularly bathe in dust to keep their feathers in good condition,[73] and caged hens still retain the natural urge to dustbathe, even when the stimulus of litter is not present.[74] In fact, battery-caged hens will try to dustbathe on the wire floor of the cage,[75] sometimes leading to plumage degradation.[76] The best experimental evidence suggests that the function of dustbathing is to balance lipid levels in the feathers.[77,78,79] However, even featherless chickens will dustbathe,[80] demonstrating that the need to perform the behavior is not based solely on external triggers, such as plumage condition or the presence of ectoparasites in the feathers, and is at least partially controlled internally by physiological factors.

Battery cages also prohibit hens from perching and roosting, natural behaviors of the hen under free-range conditions. The scientific literature suggests that the foot of a hen is "anatomically adapted to close around a perch"[81]—that is, their feet evolved to clutch onto branches. Perch use is important for maintaining bone volume and bone strength.[82,83,84] Toe pad hyperkeratosis is a thickening of skin on the feet of hens, and it has been demonstrated to be worse in cages where hens stand on wire flooring than in systems that allow birds to perch.[85,86] Baxter asserts that hens without access to perches are shown to suffer reduced welfare from "increased aggression [as perches serve as a refuge for subordinate hens], reduced bone strength, impaired foot condition and higher feather loss."[87]

Fully performing comfort behaviors, such as stretching, wing-flapping, and preening, are impaired in the battery-cage environment.[88,89,90,91] These behaviors are important for body maintenance and care of the feathers. Preference testing has found that hens prefer more space when given the opportunity to choose between enclosures that differ in size[92,93,94,95] and, when given enough space, will engage in more comfort behaviors.[96]

Metabolic Disease

Hens in cages are so intensively confined that they have no opportunity to exercise. One study demonstrated that birds in a cage-free, perchery system moved on average seven times as far as the comparison group kept in cages.[97] Caged hens are not exposed to the normal range of physical forces and dynamic loading that strengthen and structure their bones. The scientific literature provides ample evidence that restriction of normal movement to the extent found in cages causes physical harm in the form of bone fragility and impaired bone strength.[98,99,100,101,102] While all hens selectively bred for egg production are prone to osteoporosis-induced skeletal weakness, caged hens are at greater risk due to lack of exercise. Several studies have compared the bone strength of caged hens to those in perchery and deep-litter systems and concluded that bone strength is severely

reduced in caged birds.[103,104,105] Osteoporosis is so severe in caged hens that in one study, approximately one out of every four birds removed from their cages at the end of the laying period suffered from broken bones.[106]

Caged hens also suffer from cage layer fatigue, a disorder in which the skeletal system becomes critically weakened, often leading to fractures, paralysis, and death.[107,108] Cage layer fatigue was identified when laying hen flocks were first moved into cages in the 1950s, and it continues to be a "major issue."[109] Another disorder that is primarily associated with caged hens is fatty liver hemorrhagic syndrome (FLHS). Caged hens on high-energy diets are the most frequently affected by this disease,[110] and multiple sources suggest that restriction of movement and lack of exercise are factors that predispose the birds to FLHS.[111,112,113]

Summary: Laying Hens

There is a strong argument firmly based on extensive scientific evidence that cages are not appropriate environments for laying hens. The most recent comprehensive analysis of the welfare of laying hens in cages and alternative systems was the LayWel project, a collaborative effort among working groups in seven different European countries that examined data collected from 230 different hen flocks. After reviewing all of the current science, the report concluded:

> With the exception of conventional cages, we conclude that all systems have the potential to provide satisfactory welfare for laying hens….Conventional cages do not allow hens to fulfil behaviour priorities, preferences and needs for nesting, perching, foraging and dustbathing in particular. The severe spatial restriction also leads to disuse osteoporosis. We believe these disadvantages outweigh the advantages of reduced parasitism, good hygiene and simpler management. The advantages can be matched by other systems that also enable a much fuller expression of normal behaviour. A reason for this decision is the fact that every individual hen is affected for the duration of the laying period by behavioural restriction. Most other advantages and disadvantages are much less certain and seldom affect all individuals to a similar degree.[114]

Indeed, in addition to the findings of the LayWel project, many other experts agree that, in general, hen welfare is compromised more in cages than in properly managed alternative systems[115,116] and that the differences between cage and cage-free systems are such that there is a clear welfare advantage for hens who are not confined in cages.[117] According to Michael Appleby, former Senior Lecturer in Farm Animal Behavior at the University of Edinburgh:

> Battery cages present inherent animal welfare problems, most notably by their small size and barren conditions. Hens are unable to engage in many of their natural behaviors and endure high levels of stress and frustration. Cage-free egg production, while not perfect, does not entail such inherent animal welfare disadvantages and is a very good step in the right direction for the egg industry.[118]

For the first time in U.S. history, battery cages were banned by a November 2008 ballot measure in the state of California, by a nearly two-to-one margin. The intensive confinement system will be disallowed effective January 1, 2015.[119,120,121] The state of Michigan followed, with passage of state legislation in October 2009 that will phase out battery cages within ten years.[122] In Ohio, new battery cage facilities are not permitted.[123] Many major food retailers have also pledged to increase their use of cage-free eggs, including Sonic, Ruby Tuesday, Kraft and ConAgra Foods. Unilever is switching to 100% cage-free eggs for its Hellmann's light mayonnaise brand, and Wal-Mart and Costco have switched their private-label eggs to 100% cage-free.[124] In 2012 Burger King announced that it would transition to using only cage-free eggs.[125]

The Welfare of Pregnant Sows in Gestation Crates*

More than 5.8 million pigs are used for breeding in the U.S. pork industry.[126] During their nearly four-month pregnancies, most breeding sows are confined in gestation crates,[127,128] individual, concrete-floored metal cages 0.6 m (2 ft) wide by 2.1 m (7 ft) long, just slightly larger than the animal and so severely restrictive that the sow is unable to turn around.[129] Crated sows suffer a number of significant welfare problems, including elevated risk of urinary tract infections, weakened bones, lameness, behavioral restriction, and stereotypies.[130]

Although the use of gestation crates is being phased out throughout the European Union due to welfare concerns (with a total ban effective in 2013 applicable after the fourth week of pregnancy),[131] they remain a customary animal agribusiness practice in the United States. However, a clear trend toward alternative housing systems is becoming evident. Smithfield Foods,[132,133] the world's largest pig producer,[134] and Maple Leaf,[135] the largest pig producer in Canada,[136] have pledged to phase-out their confinement of sows in gestation crates, as have Cargill and Hormel, companies that together are reported to make up over one-third of the processed pork market.[137] Said Smithfield Foods CEO Larry Pope, "Our own research has demonstrated that group pens are as good as individual gestation stalls in caring for pregnant sows."[138] Many large food retailers have also committed to reducing or ending their purchases of meat from suppliers using gestation crates. For example, Celebrity chef Wolfgang Puck has committed to purchasing pork from crate-free sources for all of his restaurants,[139] and Burger King has begun purchasing crate-free pork in increasing quantities as supply becomes more consistent.[140,141] McDonald's 2008 Corporate Responsibility Report states it "has long supported suppliers that choose to move away from sow gestation crates and tethers,"[142] and in 2012 the company announced that it would work with its suppliers to phase out their use of gestation crates.[143] Other food retailers and food service providers enacting policies to move away from gestation crates include: Denny's Corporation,[144] Wendy's[145] Cracker Barrel,[146] Bon Appétit Management Company,[147] Sonic,[148] Compass Group,[149] Safeway,[150] Kroger,[151,152] and Oscar Mayer, owned by Kraft Foods.[153,154]

Physical Problems

The long-term, intensive confinement of breeding sows in gestation crates significantly impairs their health and welfare, primarily due to the animals' inability to turn around or exercise. The severe restriction of movement leads to a reduction of muscle mass and considerable reduction of bone strength, making the most basic movements difficult and increasing the chance of a sow slipping and injuring herself.[155] Successive pregnancies exacerbate the problems of diminished muscle mass and bone strength.[156]

As gestation crates are barely larger than the sow's body, she must urinate and defecate where she stands. As such, the concrete flooring of the crates are often either partially or fully slatted, designed to allow waste to fall through.[157] Living directly above the excrement pit may expose sows to aversively high levels of ammonia,[158] and respiratory disease has been found to be a major health issue for pigs kept in confinement.[159] Gestation-crated sows suffer from a higher rate of urinary tract infections than uncrated sows[160] because they are inactive, drink less water, urinate infrequently,[161] and may be in contact with their excrement.[162] These infections can result in a high mortality rate, with one study estimating that half of mortalities were caused by urinary tract infections.[163]

The unnatural flooring of gestation crates may cause damage to joints,[164] lameness,[165] and toe lesions that, according to one report, afflict up to 80% of crated sows.[166] Erosion of the cement floor from water and feed leaves rocks and sharp edges that contribute to foot, leg, and shoulder sores.[167] Bolts affixing the crates in place contribute to similar injuries,[168] as does rubbing against the bars of their enclosures and standing or lying on barren flooring.[169] As gestation crates are narrow and typically placed side-by-side in production facilities, when lying down, sows must extend their limbs into adjacent stalls where they may be stepped on.[170] Discomfort can

* For more information, see "An HSUS Report: Welfare Issues with Gestation Crates for Pregnant Sows" at www.hsus.org/farm/resources/research/practices/gestation_crates.html.

be compounded by lack of bedding materials. Without bedding, sows have little thermal protection, which can cause systemic and local cold stress, and may contribute to or exacerbate injuries to skin and limbs.[171]

In addition to external injuries, gestation-crated sows show increased resting heart rate compared to group-housed sows, probably due to decreased muscle fitness from chronic lack of exercise,[172] and are more likely to suffer decreased cardiovascular fitness than those group-housed.[173]

Psychological Problems

When pigs are not confined, they are active and expressively curious animals. Scientific observation and research have found pigs to be intelligent, social[174] animals, capable of learning complex tasks,[175,176] perceiving time, and anticipating future events.[177] When immobilized in gestation crates without environmental enrichment or mental stimulation, their psychological well-being is impaired.

Pigs would naturally segregate into small groups with stable dominance hierarchies. Under free-range conditions, sows spend approximately 31% of their time grazing, 21% rooting, 14% walking, and 6% lying down.[178] Pigs root, bite, chew, and sniff at objects and the ground itself,[179] both to forage and to generally explore their environment. Intensive confinement thwarts nearly all natural behaviors, including foraging and rooting, reducing daily activity to the time it takes a sow to eat her concentrated diet. When released from confinement into semi-natural enclosures, sows quickly engage in their natural behaviors, foraging, nest-building, and traveling long distances.[180]

When behavioral needs are denied in such highly restrictive environments, animals may perform unnatural behaviors in place of the expression of normal patterns of activity.[181] Stereotypies are characterized as movements or behaviors that are abnormal, repetitive, and seemingly have no function or goal.[182] Researchers attribute these behaviors to boredom and frustration resulting from an impoverished environment, confinement, restraint, and unfulfilled needs.[183,184] Stereotypic behaviors are more common among gestation-crated sows compared to those in group pens[185,186] and include bar-biting, head-weaving, pressing their drinkers without drinking, and making chewing motions with an empty mouth (sham or vacuum chewing).[187,188,189] The amount of time sows engage in stereotypies increases with the time spent in crates.[190] This expression of abnormal behavior is widely accepted as a sign of psychological disturbance,[191] frustration,[192] and impaired welfare.[193,194] By comparison, in situations where sows have greater freedom in more complex environments, the amount of stereotyped behavior is nearly zero.[195]

Regarding stereotypies, the European Commission's Scientific Veterinary Committee (SVC) noted, "The extent of stereotypy gives an indication of how poor the welfare is"[196]—a finding corroborated by the American Veterinary Medical Association's (AVMA's) Task Force on the Housing of Pregnant Sows, which concluded that "stereotypies are an indication of welfare problems was a strong consensus among nearly all authors whose work was reviewed."[197] Georgia Mason, Canada Research Chair in Animal Welfare at the University of Guelph, and colleague write: "Until such research increases our understanding, stereotypies should always be taken seriously as a warning sign of potential suffering…."[198]

Summary: Gestating Sows

Vast scientific evidence shows improved physical and psychological health when sows are not confined to gestation crates. Mobility is a physical requirement for all animals, and this basic fact is reflected in the concluding remarks of veterinary and scientific reviews of sow housing and welfare: The AVMA's Task Force on the Housing of Pregnant Sows reported, "Gestation stalls, particularly when used in conjunction with feed restriction, may adversely affect welfare by restricting behavior, including foraging, movement, and postural changes,"[199] and the SVC concluded, "Since overall welfare appears to be better when the sows are not confined throughout gestation, sows should preferably be kept in groups."[200]

Indeed, research has found that outdoor, crate-free systems[201] and loose housing systems[202] offer benefits to sow health and resilience. Compared with typical U.S. crate systems, deep-bedded, loose housing systems studied in Sweden result in lower cull rates and greater sow longevity.[203] Commercial operations have also recorded better reproductive performance and lower mortality rates for sows in group pens rather than individual crates.[204] Group pens with trickle feeding systems, individual feed stalls, and electronic sow feeders are all feasible options currently and successfully in use.[205,206,207] Although some of these alternatives, particularly indoor housing in small groups, do not provide for every behavioral need, they are a marked improvement to the use of gestation crates and improve the physical well-being of the sow by allowing her to walk, turn around, and lie down more comfortably. In its review, the SVC reported that group housed sows "have more exercise, more control over their environment, more opportunity for normal social interactions and better potential for the provision of opportunities to root or manipulate materials.…As a consequence, group-housed sows show less abnormality of bone and muscle development, much less abnormal behaviour, less likelihood of extreme physiological responses, less of the urinary tract infections associated with inactivity, and better cardiovascular fitness."[208]

The Welfare of Calves in Veal Crates*

As defined by the U.S. Department of Agriculture (USDA) Food Safety and Inspection Service (FSIS), veal "is the meat from a calf or young beef animal. A veal calf is raised until about 16-18 weeks of age, weighing up to 450 pounds [204 kg]. Male dairy calves are used in the veal industry. Dairy cows must give birth to continue producing milk, but male dairy calves are of little or no value to the dairy farmer. A small percentage are raised to maturity and used for breeding."[209] More than 450,000 calves are raised for veal in the United States annually.[210]

Intensive confinement of calves raised for veal has long raised pointed concerns regarding the animals' welfare. Presently, many calves raised for veal in the United States are confined in individual crates typically measuring approximately 66-76 cm (2.1-2.5 ft) wide.[211,212] In 2006, Arizona voters approved the nation's first state-wide veal crate ban.[213] Colorado followed in 2008 with a ten-year phase-out banning veal crates,[214] and in November of that year, California voters passed a ballot measure that bans veal crates, which takes effect on January 1, 2015.[215,216] Maine followed in May 2009 and passed a law banning veal crates for calves effective Jan. 1, 2011.[217] Michigan followed in October 2009, with passage of state legislation that will phase out veal crates within ten years.[218] The Livestock Care Standards Board in Ohio issued a rule requiring that calves raised for veal must be group housed by 10 weeks of age, starting December 31, 2017.[219]

Industry itself has also been moving away from their use. Two of the largest U.S. veal producers, Strauss Veal[220] and Marcho Farms,[221] have already pledged to phase out veal crates, and convert their operations to crate-free group housing due to animal welfare concerns. As reported by *Meat Processing*, Strauss Veal & Lamb International "is committed to raising veal calves in a more humane manner. The company's goal is to be 100-percent converted to raising calves by the European-style, group-raised method within the next two to three years." Randy Strauss, co-president and CEO, stated to the industry journal that "this is the right thing to do...The traditional way of raising veal calves involves putting each calf in an individual stall. This practice is increasingly being frowned upon by a growing number of customers and consumers alike throughout the world."[222] Industry journal *Feedstuffs* reported eight months later that the American Veal Association's board of directors "unanimously approved new policy that the veal industry fully transition to group housing production by the end of 2017."[223] In 2012 the American Veal Association announced that 70% of veal calves raised by its members would be housed in group pens by the end of the year.[224]

Crated calves are typically tied to the front of the crate with a short tether, restricting virtually all movement.[225] Stressful conditions lead to high incidence of stereotypic behavior and illness. In its 1995 report, the SVC concluded:

* For more information, see "An HSUS Report: The Welfare of Animals in the Veal Industry" at www.hsus.org/farm/resources/research/welfare/welfare_veal_calves.html.

> The welfare of calves is very poor when they are kept in small individual pens with insufficient room for comfortable lying, no direct social contact and no bedding or other material to manipulate….Every calf should be able to groom itself properly, turn around, stand up and lie down normally and lie with its legs stretched out if it wishes to do so.[226]

Impacts of Intensive Confinement

Confining calves to crates, where they remain nearly immobilized until they reach slaughter weight, presents many welfare problems. One of the greatest deprivations individually housed calves suffer is the ability to adopt their preferred lying posture and to stand and lie down naturally.[227] As a primary purpose of lying down is to relax certain muscles, the restrictions that crates and tethers place on most normal lying postures of calves may impede full relaxation of the body and prevent the animals from lying comfortably.[228] For all young mammals, rest is critical, and sleep disruption may occur if certain lying positions cannot be adopted.[229] Lying posture is also very important for thermoregulation,[230] as overheated calves adopt positions that maximize the surface area from which heat can be lost. Such positions usually involve stretching out the legs laterally.

Calves, like all young mammals, have a need for regular exercise, which helps reduce problems associated with inactivity,[231] such as abnormal bone and muscle development and joint disorders. Intensive confinement systems prohibit exercise and normal muscle growth.[232] When given space, healthy calves will play, gallop, buck, and kick,[233] and when with other calves, they will also engage in play fighting.[234] In contrast, when closely confined for prolonged periods, these normal behaviors are thwarted, resulting in an intensification of the drive to perform these activities.[235]

Cattle are social animals who obtain physical, physiological, and psychological comfort from each other.[236] Under natural conditions, calves would associate in groups during the day from two weeks of age while their mothers forage and would begin to form relationships with their peers.[237] For calves raised without their mothers, social contact with other calves is of even greater importance.[238] Confining calves prevents the animals from adequate social contact, and researchers from the Danish Institute of Agricultural Sciences and the University of Copenhagen in Denmark found that calves were willing to work to gain access to social contact.[239] They concluded that "[c]alves' welfare may be threatened if they are not allowed to perform social behaviors, and since motivation is apparently higher for full social contact than for head contact it is likely that their welfare will be better if housed in groups…."[240]

In order to maintain personal hygiene and help prevent disease, calves groom themselves, principally by licking. Cattle naturally lick all the parts of their body they can reach, though tethered calves are unable groom the hind parts of their body because of restrictions imposed by the stall and tether. Excessive licking of the forelegs, a re-directed behavior, is common in stall and tether systems.[241]

The chronic deprivation of needs and behaviors can lead to stress.[242] Texas A&M University Department of Animal Science Professor Ted Friend and associates found that calves tethered in stalls had higher adrenal responses than group-housed calves, as well as increased levels of thyroid hormones and a higher neutrophil to lymphocyte ratio, another physiological indicator of chronic stress.[243]

Young calves are susceptible to pathogens and individual housing is used, in part, because it may help to reduce the transmission of pathogenic organisms by minimizing animal-to-animal contact.[244] The slatted partitions do not protect against airborne transmission, however, and calves in crates still have head to head contact. Friend and colleague conclude: "Thus, there remain many avenues for transmission of disease in most crate-housing systems."[245]

Summary: Calves Raised for Veal

The cruelty of the veal crate is well-established. Nearly two decades ago, Friend testified before a legislative committee, explaining the results of his study on veal calf welfare funded by the U.S. Department of Agriculture:

> Our results show that calves have a very strong drive to move or exercise that is blocked by chronic close confinement. The studies also found that maintaining calves in close confinement causes adverse physiological effects that alter metabolism and reduce the ability of the calf's immune system to respond to disease. All of these are changes in the body that are indicative of chronic stress….We also found that all of the symptoms of chronic stress were eliminated after the calves were removed from the crates….To summarize, our studies found that maintaining calves in crates is physically detrimental to the calf, something that is common knowledge in the industry.[246]

The customary veal production practices in the United States of close, restrictive confinement and social isolation have been widely criticized on animal welfare grounds. They are currently illegal in all 27 countries of the European Union.[247,248]

Studies clearly show that eliminating crates and switching to group housing would benefit calves.[249] Group-housed calves have the opportunity for locomotion, social behavior, and more comfortable lying positions.[250] In its *Report on the Welfare of Calves*, the SVC wrote: "[G]eneral comparisons indicate that the housing of calves in individual pens, and the tethering of calves, results in problems for their welfare which are significantly reduced when the calves are group-housed on straw."[251]

Conclusion

In the absence of any federal laws regulating the on-farm treatment of the billions of animals raised for meat, eggs, and milk, farm animals suffer immensely.

Animals, including those farmed, are fully capable of feeling pain and suffering,[252,253,254] as well as positive emotions.[255,256] Intensively confined farm animals undoubtedly suffer as would dogs or cats if continuously kenneled without the opportunity to exercise or even engage in the most basic of movements.

Battery cages for hens and crates for calves and sows are inherently flawed. These barren, restrictive housing systems so severely impair normal movement that the expression of nearly all normal behaviors are thwarted, leading to significant and prolonged physical and psychological assaults. Adequate welfare of a hen in a battery-cage or a sow or a calf in a crate simply cannot be provided, and the scientific literature, particularly in the field of ethology, is very clear on this point. Alternative production systems exist for each of these forms of confinement, and forward-thinking producers are already moving toward housing practices that allow fuller expression of most forms of meaningful natural behavior.[257] Addressing the many welfare concerns with intensive confinement practices[258,259,260] necessarily mandates industry shifts away from the intensive confinement of laying hens, pregnant sows, and calves raised for veal in battery cages, gestation crates, and veal crates, respectively.

After a comprehensive two-year study, the independent Pew Commission on Industrial Farm Animal Production, a project of The Pew Charitable Trusts and the Johns Hopkins Bloomberg School of Public Health chaired by former Kansas Governor John Carlin and including former U.S. Agriculture Secretary Dan Glickman, concluded that cages and crates should be phased out:

> After reviewing the literature, visiting production facilities, and listening to producers themselves, the Commission believes that the most intensive confinement systems, such as restrictive veal crates, hog

gestation pens, restrictive farrowing crates, and battery cages for poultry, all prevent the animal from a normal range of movement and constitute inhumane treatment.[261]

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[1] Zogby International. 2003. Nationwide views on the treatment of farm animals. Poll for the Animal Welfare Trust.
[2] Moore DW. 2003. Public lukewarm on animal rights: supports strict laws governing treatment of farm animals, but opposes bans on product testing and medical research. Media release issued May 21. Gallup Poll News Service.
[3] Lusk JL, Norwood FB, and Prickett RW. 2007. Consumer preferences for farm animal welfare: results of a nationwide telephone survey. http://asp.okstate.edu/baileynorwood/Survey4/files/InitialReporttoAFB.pdf. Accessed July 25, 2012.
[4] Penn, Schoen & Berland Associates. 2005. Poll for the Humane Society of the United States, Washington, DC.
[5] Smithfield Foods. 2007. Smithfield Foods makes landmark decision regarding animal management. Press release issued January 25. www.prnewswire.com/news-releases/smithfield-foods-makes-landmark-decision-regarding-animal-management-53754097.html. Accessed July 8, 2012.
[6] Stewart J. 2007. Maple Leaf to phase out sow gestation stalls. The Star Phoenix, February 1. www.canada.com/saskatoonstarphoenix/news/business/story.html?id=dff218dc-2667-4996-8392-dbfde43c13d6. Accessed July 8, 2012.
[7] Pig Progress. 2007. Cargill not phasing out gestation crates. Pig Progress.net, April 16. www.pigprogress.net/news/cargill-not-phasing-out-gestation-crates-552.html. Accessed July 8, 2012 .
[8] Brown C. 2007. Puck says it's time to hold the foie gras. Los Angeles Times, March 22.
[9] Martin A. 2007. Burger King shifts policy on animals. The New York Times, March 28. www.nytimes.com/2007/03/28/business/28burger.html?ei=5124&en=7104231631119310&ex=1332734400&pagewanted=print. Accessed July 8, 2012.
[10] Storck AB. 2007. Veal processor switches to new calf-housing system. Meatingplace.com, January 29.
[11] Severson K. 2007. Suddenly, the hunt is on for cage-free eggs. The New York Times, August 12. www.nytimes.com/2007/08/12/us/12eggs.html. Accessed July 8, 2012.
[12] Trader Joe's. Action Issues. www.traderjoes.com/action_issues.asp#Eggs. Accessed July 8, 2012.
[13] Curtis SE. 2007. Performance indicates animal state of being: a Cinderella axiom? The Professional Animal Scientist 23:573-83.
[14] Riddell C. 1992. Non-infectious skeletal disorders of poultry: an overview. In: Whitehead CC (ed.), Bone Biology and Skeletal Disorders in Poultry. Poultry Science Symposium Number Twenty-three (Oxfordshire, U.K.: Carfax Publishing Company, pp. 137-8).
[15] Broom DM. 2000. Does present legislation help animal welfare? Sustainable Animal Production: Workshops, Discussion, Online Resources. www.agriculture.de/acms1/conf6/ws5alegisl.htm. Accessed July 8, 2012.
[16] Mench JA. 1992. The welfare of poultry in modern production systems. Poultry Science Review 4(2):107-28.
[17] Appleby MC. 2005. Welfare challenges in sow housing. Journal of the American Veterinary Medical Association 226(8):1334-6.
[18] Rollin BE. 2001. Farm factories. The Christian Century, December 19. www.religion-online.org/showarticle.asp?title=2194. Accessed July 8, 2012.
[19] Duncan IJH. 1970. Frustration in the fowl. In: Freeman BM and Gordon RF (eds.), Aspects of Poultry Behaviour (Edinburgh, Scotland: British Poultry Science Ltd., pp. 15-31).
[20] Špinka M. 2006. How important is natural behaviour in animal farming systems. Applied Animal Behaviour Science 100(1-2):117-28.
[21] Baxter M. 1994. The welfare problems of laying hens in battery cages. The Veterinary Record 134(24):614-9.
[22] Dawkins MS. 1990. From an animal's point of view: motivation, fitness, and animal welfare. Behavioral and Brain Sciences 13:1-61.
[23] Vestergaard K. 1984. An evaluation of ethological criteria and methods in the assessment of well-being in sows. Annales de Recherches Vétérinaires (Annals of Veterinary Research) 15(2):227-36.
[24] Broom DM, Mendl MT, and Zanella AJ. 1995. A comparison of the welfare of sows in different housing conditions. Animal Science 61:369-85.

[25] European Commission, Scientific Veterinary Committee, Animal Welfare Section. 1995. Report on the welfare of calves. Adopted November 9. http://ec.europa.eu/food/fs/sc/oldcomm4/out35_en.pdf. Accessed July 12, 2012.
[26] Dawkins MS. 1983. Battery hens name their price: consumer demand theory and the measurement of ethological 'needs.' Animal Behaviour 31(4):1195-205.
[27] Jensen P and Toates FM. 1993. Who needs 'behavioural needs'? Motivational aspects of the needs of animals. Applied Animal Behaviour Science 37(2):161-81.
[28] United Egg Producers. 2012. U.S. egg industry: general U.S. stats. www.unitedegg.org/GeneralStats/default.cfm. Accessed July 25, 2012.
[29] United Egg Producers. 2010. United Egg Producers Animal Husbandry Guidelines for U.S. Egg Laying Flocks, 2010 Edition (Alpharetta, GA: United Egg Producers). www.unitedegg.org/information/pdf/UEP_2010_Animal_Welfare_Guidelines.pdf. Accessed July 25, 2012.
[30] Dawkins MS and Hardie S. 1989. Space needs of laying hens. British Poultry Science 30:413-6.
[31] U.S. Department of Agriculture, National Agricultural Statistics Service. 2012. Quarterly hogs and pigs, June 29. http://usda01.library.cornell.edu/usda/current/HogsPigs/HogsPigs-06-29-2012.pdf. Accessed July 25, 2012
[32] Barnett JL, Hemsworth PH, Cronin GM, Jongman EC, and Hutson GD. 2001. A review of the welfare issues for sows and piglets in relation to housing. Australian Journal of Agricultural Research 52:1-28.
[33] National Pork Producers Council. 2012. Survey shows few sows in open housing. National Hog Farmer, June 7. http://nationalhogfarmer.com/animal-well-being/survey-shows-few-sows-open-housing. Accessed July 15, 2012.
[34] Commission of the European Communities. 2001. COM(2001) 20 final 2001/0021 (CNS) Communication from the Commission to the Council and the European Parliament on the welfare of intensively kept pigs in particularly taking into account the welfare of sows reared in varying degrees of confinement and in groups. Proposal for a Council Directive amending Directive 91/630/EEC laying down minimum standards for the protection of pigs.
[35] U.S. Department of Agriculture, National Agricultural Statistics Service. 2006. U.S. hog breeding herd structure. http://usda.mannlib.cornell.edu/usda/current/hog-herd/hog-herd-09-22-2006.pdf. Accessed July 8, 2012.
[36] U.S. Department of Agriculture, Food Safety and Inspection Service. 2006. Veal from farm to table. www.fsis.usda.gov/Fact_Sheets/Veal_from_Farm_to_Table/index.asp. Accessed July 2, 2012.
[37] Wilson LL, Stull CL, and Terosky TL. 1995. Veal perspectives to the year 2000: scientific advancements and legislation addressing veal calves in North America. Proceedings of the International Symposium in Le Mans, France, September 12-13.
[38] Stull CL and McDonough SP. 1994. Multidisciplinary approach to evaluating welfare of veal calves in commercial facilities. Journal of Animal Science 72(9):2518-24.
[39] Andrighetto I, Gottardo F, Andreoli D, and Cozzi G. 1999. Effect of type of housing on veal calf growth performance, behaviour and meat quality. Livestock Production Science 57(2):137-45.
[40] Friend TH and Dellmeier GR. 1988. Common practices and problems related to artificially rearing calves: an ethological analysis. Applied Animal Behaviour Science 20(1/2):47-62.
[41] Špinka M. 2006. How important is natural behaviour in animal farming systems. Applied Animal Behaviour Science 100(1-2):117-28.
[42] Mendl MT. 1991. The effects of alternative forms of intensive pig husbandry on measures of pig welfare. In: Bradley A and Sckofield WL (eds.), Proceedings of the First Association of Veterinary Students Animal Welfare Symposium (Cambridge, U.K.: Association of Veterinary Students).
[43] European Commission. 1999. Animal welfare on the farm—laying hens. http://ec.europa.eu/food/animal/welfare/farm/laying_hens_en.htm. Accessed July 2, 2012.
[44] Commission of the European Communities. 2001. Council Directive 2001/88/EC of 23 October 2001 amending Directive 91/630/EEC laying down minimum standards for the protection of pigs. Official Journal of the European Communities L316:1-4.
[45] Council of Europe. 1997. Council Directive 97/2/EC of 20 January 1997 amending Directive 91/629/EEC laying down minimum standards for the protection of calves. http://ec.europa.eu/food/fs/aw/aw_legislation/calves/97-2-ec_en.pdf. Accessed July 8, 2012.

[46] Colorado Enrolled Senate Bill 08-201 (2008) www.leg.state.co.us/clics/clics2008a/csl.nsf/fsbillcont3/15738AC63DFF2DB1872573E600643253?open&file=201_enr.pdf. Accessed July 8, 2012.
[47] Arizona Secretary of State's Office. 2006. Ballot Proposition Guide. Official Proposition 204 language. www.azsos.gov/election/2006/Info/PubPamphlet/Sun_Sounds/english/Prop204.htm. Accessed July 8, 2012.
[48] Michigan Enrolled House Bill 5127 .2009. www.legislature.mi.gov/documents/2009-2010/billenrolled/House/pdf/2009-hNB-5127.pdf. Accessed July 15, 2012.
[49] Maine Public Law, Chapter 127 LD 1021, item 1 (2009) www.mainelegislature.org/legis/bills/bills_124th/chappdfs/PUBLIC127.pdf. Accessed July 8, 2012.
[50] Florida Constitution Article 10, Section 21 (2004) www.leg.state.fl.us/statutes/index.cfm?mode=constitution&submenu=3&tab=statutes - A10S21. Accessed December 30, 2009.
[51] Oregon Enrolled Senate Bill 694 (2007) www.leg.state.or.us/07reg/measpdf/sb0600.dir/sb0694.en.pdf. Accessed July 8, 2012 .
[52] Marcelo P. 2012. New R.I. law bans cutting dairy-cow tails, raising pigs and calves in crates. Providence Journal, June 21. http://news.providencejournal.com/politics/2012/06/new-ri-law-bans-cutting-dairy-cow-tails-raising-pigs-and-calves-in-crates.html. Accessed July 15, 2012.
[53] California Proposition 2 (2008) www.sos.ca.gov/elections/sov/2008_general/maps/returns/props/prop-2.htm. Accessed July 8, 2012.
[54] Michigan Enrolled House Bill 5127 (2009) www.legislature.mi.gov/documents/2009-2010/billenrolled/House/pdf/2009-hNB-5127.pdf. Accessed July 8, 2012.
[55] Ohio Department of Agriculture. Administrative code 901:12, Livestock care standards. www.agri.ohio.gov/LivestockCareStandards/docs/Livestock%20Care%20Standards%20(EFFECTIVE).pdf. Accessed July 8, 2012.
[56] Bell DD. 2002. Cage management for layers. In: Bell DD and Weaver WD (eds.), Commercial Chicken Meat and Egg Production, 5th Edition (Norwell, MA: Kluwer Academic Publishers).
[57] United Egg Producers. 2010. United Egg Producers Animal Husbandry Guidelines for U.S. Egg Laying Flocks, 2008 Edition (Alpharetta, GA: United Egg Producers). www.unitedegg.org/information/pdf/UEP_2010_Animal_Welfare_Guidelines.pdf. Accessed July 25, 2010.
[58] Tauson R and Abrahamsson P. 1996. Foot and keel bone disorders in laying hens: effects of artificial perch material and hybrid. Acta Agriculturæ Scandinavica Section A, Animal Science 46:239-46.
[59] Norgaard-Nielsen G. 1990. Bone strength of laying hens kept in an alternative system compared with hens in cages and on deep-litter. British Poultry Science 31(1):81-9.
[60] Leeson S. 2007. Metabolic challenges: past, present, and future. Journal of Applied Poultry Research 16:121-5.
[61] Wood-Gush DG and Gilbert AB. 1973. Some hormones involved in the nesting behaviour of hens. Animal Behaviour 21(1):98-103.
[62] Duncan IJH. 1998. Behavior and behavioral needs. Poultry Science 77(12):1766-72.
[63] Cooper JJ and Appleby MC. 2003. The value of environmental resources to domestic hens: a comparison of the work-rate for food and for nests as a function of time. Animal Welfare 12(1):39-52.
[64] Duncan IJH. 2001. The pros and cons of cages. World's Poultry Science Journal 57(4):381-90.
[65] Baxter M. 1994. The welfare problems of laying hens in battery cages. The Veterinary Record 134(24):614-9.
[66] Duncan IJH. 1970. Frustration in the fowl. In: Freeman BM and Gordon RF (eds.), Aspects of Poultry Behaviour (Edinburgh, Scotland: British Poultry Science Ltd., pp. 15-31).
[67] Baxter M. 1994. The welfare problems of laying hens in battery cages. The Veterinary Record 134(24):614-9.
[68] Appleby MC, Hughes BO, and Elson HA. 1992. Poultry Production Systems: Behaviour, Management, and Welfare (Wallingford, U.K.: CAB International).
[69] Sherwin CM and Nicol CJ. 1992. Behaviour and production of laying hens in three prototypes of cages incorporating nests. Applied Animal Behaviour Science 35(1):41-54.
[70] Hughes BO. 1983. Space requirements in poultry. In: Baxter SH, Baxter MR, and MacCormack JAD (eds.), Farm Animal Housing and Welfare (Boston, MA: Martinus Nijhoff Publishers).
[71] Duncan IJH and Hughes BO. 1972. Free and operant feeding in domestic fowls. Animal Behaviour 20:775-7.

[72] Dawkins MS. 1989. Time budgets in Red Junglefowl as a baseline for the assessment of welfare in domestic fowl. Applied Animal Behaviour Science 24:77-80.
[73] Van Liere DW and Bokma S. 1987. Short-term feather maintenance as a function of dust-bathing in laying hens. Applied Animal Behaviour Science 18(2):197-204.
[74] Mench JA. 1992. The welfare of poultry in modern production systems. Poultry Science Review 4(2):107-28.
[75] Vestergaard K. 1987. Dust-bathing of hens with and without access to sand. Applied Animal Behaviour Science 17(3-4):380.
[76] Simonsen H, Vestergaard K, and Willeberg P. 1980. Effect of floor type and density on the integument of egg layers. Poultry Science 59:2202-6.
[77] Van Liere DW and Bokma S. 1987. Short-term feather maintenance as a function of dust-bathing in laying hens. Applied Animal Behaviour Science 18(2):197-204.
[78] Olsson IAS and Keeling LJ. 2005. Why in earth? Dustbathing behaviour in jungle and domestic fowl reviewed from a Tinbergian and animal welfare perspective. Applied Animal Behaviour Science 93(3/4):259-82.
[79] Shields SJ. 2004. Dustbathing by broiler chickens: characteristics, substrate preference, and implications for welfare. Ph.D. Dissertation, University of California, Davis.
[80] Vestergaard KS, Damm BI, Abbott UK, and Bildsoe M. 1999. Regulation of dustbathing in feathered and featherless domestic chicks: the Lorenzian model revisited. Animal Behaviour 58(5):1017-25.
[81] Baxter M. 1994. The welfare problems of laying hens in battery cages. The Veterinary Record 134(24):614-9.
[82] Wilson S, Hughes BO, Appleby MC, and Smith SF. 1993. Effects of perches on trabecular bone volume in laying hens. Research in Veterinary Science 54(2):207-11.
[83] Hughes BO, Wilson S, Appleby MC, and Smith SF. 1993. Comparison of bone volume and strength as measures of skeletal integrity in caged laying hens with access to perches. Research in Veterinary Science 54(2):202-6.
[84] Duncan ET, Appleby MC, and Hughes BO. 1992. Effect of perches in laying cages on welfare and production of hens. British Poultry Science 33(1):25-35.
[85] Tauson R and Abrahamsson P. 1996. Foot and keel bone disorders in laying hens: effects of artificial perch material and hybrid. Acta Agriculturæ Scandinavica Section A, Animal Science 46:239-46.
[86] Tauson R, Wahlstrom A, and Abrahamsson P. 1999. Effect of two floor housing systems and cages on health, production, and fear response in layers. Journal of Applied Poultry Research 8(2):152-9.
[87] Baxter M. 1994. The welfare problems of laying hens in battery cages. The Veterinary Record 134(24):614-9.
[88] Nicol CJ. 1987. Effect of cage height and area on the behaviour of hens housed in battery cages. British Poultry Science 28(2):327-35.
[89] Appleby MC, Mench JA, and Hughes BO. 2004. Poultry Behaviour and Welfare (Wallingford, U.K.: CABI Publishing).
[90] Tanaka T and Hurnik JF. 1992. Comparison of behavior and performance of laying hens housed in battery cages and an aviary. Poultry Science 71(2):235-43.
[91] Duncan IJH. 1981. Animal rights—animal welfare: a scientist's assessment. Poultry Science 60(3):489-99, citing: Wennrich VG and Strauss DD. 1977. Zum nachweis eines "triebstaus" bei haushennen. Deutsche Tierarztliche Wochenschrift 84(8):310-316.
[92] Hughes BO. 1975. Spatial preference in the domestic hen. British Veterinary Journal 131(5):560-4.
[93] Dawkins M. 1978. Welfare and the structure of a battery cage: size and cage floor preferences in domestic hens. British Veterinary Journal 134(5):469-75.
[94] Nicol CJ. 1986. Non-exclusive spatial preference in the laying hen. Applied Animal Behaviour Science 15:337-50.
[95] Dawkins M. 1981. Priorities in the cage size and flooring preferences of domestic hens. British Poultry Science 22(3):255-63.
[96] Nicol CJ. 1987. Effect of cage height and area on the behaviour of hens housed in battery cages. British Poultry Science 28(2):327-35.
[97] McLean KA, Baxter MR, and Michie W. 1986. A comparison of the welfare of laying hens in battery cages and in a perchery. Research and Development in Agriculture 3(2):93-8.

[98] Hughes BO. 1983. Space requirements in poultry. In: Baxter SH, Baxter MR, and MacCormack JAD (eds.), Farm Animal Housing and Welfare (Boston, MA: Martinus Nijhoff Publishers).
[99] Rowland LO and Harms RH. 1970. The effect of wire pens, floor pens and cages on bone characteristics of laying hens. Poultry Science 49(5):1223-5.
[100] Wabeck CJ and Littlefield LH. 1972. Bone strength of broilers reared in floor pens and in cages having different bottoms. Poultry Science 51(3):897-9.
[101] Meyer WA and Sunde ML. 1974. Bone breakage as affected by type housing or an exercise machine for layers. Poultry Science 53(3):878-85.
[102] Nightingale TE, Littlefield LH, Merkley JW, and Richardi JC. 1974. Immobilization-induced bone alterations in chickens. Canadian Journal of Physiology and Pharmacology 52(5):916-9.
[103] Norgaard-Nielsen G. 1990. Bone strength of laying hens kept in an alternative system compared with hens in cages and on deep-litter. British Poultry Science 31(1):81-9.
[104] McLean KA, Baxter MR, and Michie W. 1986. A comparison of the welfare of laying hens in battery cages and in a perchery. Research and Development in Agriculture 3(2):93-8.
[105] Knowles TG and Broom DM. 1990. Limb bone strength and movement in laying hens from different housing systems. The Veterinary Record 126(15):354-6.
[106] Gregory NG and Wilkins LJ. 1989. Broken bones in domestic fowl: handling and processing damage in end-of-lay battery hens. British Poultry Science 30(3):555-62.
[107] Riddell C. 1992. Non-infectious skeletal disorders of poultry: an overview. In: Whitehead CC (ed.), Bone Biology and Skeletal Disorders in Poultry. Poultry Science Symposium Number Twenty-three (Oxfordshire, U.K.: Carfax Publishing Company, pp. 137-8).
[108] Mississippi State University Cooperative Extension Service. 2010. Miscellaneous management related diseases. http://msucares.com/poultry/diseases/dismisc.htm. Accessed July 8, 2012 .
[109] Leeson S. 2007. Metabolic challenges: past, present, and future. Journal of Applied Poultry Research 16:121-5.
[110] The Merck Veterinary Manual. 2006. Fatty liver syndrome: Introduction. http://merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/202400.htm. Accessed July 8, 2012.
[111] Mississippi State University Cooperative Extension Service. 1997. Miscellaneous management related diseases. http://msucares.com/poultry/diseases/dismisc.htm. Accessed July 8, 2012.
[112] European Food Safety Authority, Animal Health and Animal Welfare. 2005. The welfare aspects of various systems of keeping laying hens. Annex to the EFSA Journal 197:1-23. www.efsa.europa.eu/EFSA/Scientific_Opinion/annexc3pictureslayinghens1.pdf. Accessed July 8, 2012.
[113] Crespo R and Shivaprasad HL. 2003. Developmental, metabolic, and other noninfectious disorders. In: Saif YM, Barnes HJ, Glisson JR, Fadly AM, McDougald LR, and Swayne DE (eds.), Diseases of Poultry, 11th Edition (Ames, IA: Iowa State Press, pp. 1082-3).
[114] LayWel. 2006. Welfare implications of changes in production systems for laying hens.www.laywel.eu/web/pdf/deliverable%2071%20welfare%20assessment.pdf. Accessed July 8, 2012.
[115] Appleby MC. 1991. Do hens suffer in battery cages? A review of the scientific evidence commissioned by the Athene Trust. www.ciwf.org.uk/includes/documents/cm_docs/2008/d/do_hens_suffer_in_battery_cages_1991.pdf. Accessed July 8, 2012.
[116] Appleby MC and Hughes BO. 1991. Welfare of laying hens in cages and alternative systems: environmental, physical and behavioural aspects. World's Poultry Science Journal 47(2):109-28.
[117] McLean KA, Baxter MR, and Michie W. 1986. A comparison of the welfare of laying hens in battery cages and in a perchery. Research and Development in Agriculture 3(2):93-8.
[118] Appleby MC. 2006. Letter to the editor: Clarification. The Minnesota Daily, February 7.
[119] California Health and Safety Code, Division 20, Chapter 13.8, Farm Animal Cruelty, Section 25990-25994. http://codes.lp.findlaw.com/cacode/HSC/1/d20/13.8. Accessed July 25, 2012.
[120] California Secretary of State Debra Bowen. 2008. Statement of Vote, November 4, 2008, General Election. www.sos.ca.gov/elections/sov/2008_general/sov_complete.pdf. Accessed July 8, 2012 .
[121] California Proposition 2 (2008) www.sos.ca.gov/elections/sov/2008_general/maps/returns/props/prop-2.htm. Accessed July 25, 2012.

[122] Michigan Enrolled House Bill 5127 (2009) www.legislature.mi.gov/documents/2009-2010/billenrolled/House/pdf/2009-hNB-5127.pdf. Accessed July 8, 2012.
[123] Ohio Department of Agriculture. Administrative code 901:12-9, Livestock care standards, poultry-layers. www.agri.ohio.gov/LivestockCareStandards/docs/Livestock%20Care%20Standards%20(EFFECTIVE).pdf. Accessed July 7, 2012
[124] Cone T. 2012. Burger King makes cage-free promise. Associated Press, April 25. www.cbsnews.com/8301-505123_162-57420807/burger-king-makes-cage-free-promise/. Accessed July 7, 2012
[125] Tomson B. 2012. Burger King pledges shift to 'cage-free' eggs. Wall Street Journal, Market Watch, April 25. www.marketwatch.com/story/burger-king-pledges-shift-to-cage-free-eggs-2012-04-25. Accessed July 7, 2012.
[126] U.S. Department of Agriculture, National Agricultural Statistics Service. 2012. Quarterly hogs and pigs, www.usda.gov/nass/PUBS/TODAYRPT/hgpg0312.pdf. Accessed July 7, 2012.
[127] Barnett JL, Hemsworth PH, Cronin GM, Jongman EC, and Hutson GD. 2001. A review of the welfare issues for sows and piglets in relation to housing. Australian Journal of Agricultural Research 52:1-28.
[128] National Pork Producers Council. 2012. Survey shows few sows in open housing. National Hog Farmer, June 7. http://nationalhogfarmer.com/animal-well-being/survey-shows-few-sows-open-housing. Accessed July 15, 2012.
[129] Commission of the European Communities. 2001. COM(2001) 20 final 2001/0021 (CNS) Communication from the Commission to the Council and the European Parliament on the welfare of intensively kept pigs in particularly taking into account the welfare of sows reared in varying degrees of confinement and in groups. Proposal for a Council Directive amending Directive 91/630/EEC laying down minimum standards for the protection of pigs.
[130] European Commission. 1997. Report of the Scientific Veterinary Committee, Animal Welfare Section. The welfare of intensively kept pigs. Doc XXIV/B3/ScVC/0005/1997, p. 93. http://ec.europa.eu/food/fs/sc/oldcomm4/out17_en.pdf. Accessed July 8, 2012.
[131] Commission of the European Communities. 2001. Council Directive 2001/88/EC of 23 October 2001 amending Directive 91/630/EEC laying down minimum standards for the protection of pigs. Official Journal of the European Communities L316:1-4.
[132] Smithfield Foods. 2007. Smithfield Foods makes landmark decision regarding animal management. Press release issued January 25. www.prnewswire.com/news-releases/smithfield-foods-makes-landmark-decision-regarding-animal-management-53754097.html. Accessed July 8, 2012.
[133] Friedland D. 2011. Smithfield to meet 2011 gestation stall conversion goal. Meatingplace, December 8. www.meatingplace.com/Industry/News/Details/29011?item=29011. Accessed May 10, 2012.
[134] Smithfield. About Smithfield Foods. www.smithfieldfoods.com/our_company/about_us.aspx. Accessed July 25, 2012.
[135] Maple Leaf Foods. 2007. Maple Leaf endorses U.S. industry direction on sow stalls. Press release issued January 31. http://investor.mapleleaf.ca/phoenix.zhtml?c=88490&p=irol-newsArticle&ID=956262&highlight. Accessed July 8, 2012.
[136] Successful Farming. 2007. Pork powerhouses 2007. http://images.meredith.com/ag/pdf/2007SFPorkPowerhouses07.pdf. Accessed July 8, 2012.
[137] Meatingplace editorial. 2012. The big one. Meatingplace, March. www.meatingplace.com/Print/Archives/Details/4138. Accessed May 10, 2012.
[138] McDonald's Corporation. 2008. Worldwide Corporate Responsibility Report: Responsible Food for a Sustainable Future, p.23. www.aboutmcdonalds.com/content/dam/AboutMcDonalds/Sustainability/Sustainability%20Library/mcd048_2008report_v5.pdf. Accessed July 25, 2012.
[139] The Wolfgang Puck Companies. 2007. Chef Wolfgang Puck takes eating well to new level benefiting farm animals and customers. Press release issued March 22. www.tribeofheart.org/pdf/puckhumanepr.pdf. Accessed July 25, 2012.
[140] Martin A. 2007. Burger King shifts policy on animals. The New York Times, March 28. www.nytimes.com/2007/03/28/business/28burger.html?ei=5124&en=7104231631119310&ex=1332734400&pagewanted=print. Accessed July 8, 2012.

[141] Tomson B. 2012. Burger King pledges shift to 'cage-free' eggs. Wall Street Journal, Market Watch, April 25. www.marketwatch.com/story/burger-king-pledges-shift-to-cage-free-eggs-2012-04-25. Accessed July 7, 2012.
[142] McDonald's Corporation. 2008. Worldwide Corporate Responsibility Report: Responsible Food for a Sustainable Future, p.23. www.aboutmcdonalds.com/content/dam/AboutMcDonalds/Sustainability/Sustainability%20Library/mcd048_2008report_v5.pdf. Accessed July 25, 2012.
[143] Strom S. 2012. McDonald's set to phase out suppliers' use of sow crates. The New York Times, February 13. www.nytimes.com/2012/02/14/business/mcdonalds-vows-to-help-end-use-of-sow-crates.html?_r=1. Accessed July 7, 2012.
[144] Hsu T. 2012. Denny's switches to pigs that aren't housed in cramped crates. LA Times, May 15. www.latimes.com/business/money/la-fi-mo-dennys-gestation-crates-20120515,0,1840804.story. Accessed July 15, 2012
[145] Miller M. 2012. Wendy's commits to gestation-stall-free pork. Pork Magazine, March 26. www.porknetwork.com/e-newsletters/pork-daily/Wendys-commits-to-gestation-stall-free-pork-144153905.html. Accessed July 15, 2012.
[146] Wyatt D. 2012. Cracker Barrel pursues cruelty-free pork. The Tennessean, June 14. www.tennessean.com/article/20120614/BUSINESS01/306140033/Cracker-Barrel-pursues-cruelty-free-pork. Accessed July 15, 2012.
[147] 2012. The push for humane. QSR Magazine, June 5. www.qsrmagazine.com/consumer-trends/push-humane. Accessed July 15, 2012.
[148] 2012. Sonic to end pig confinement by 2022. QSR Magazine, June 18. www.qsrmagazine.com/news/sonic-end-pig-confinement-2022. Accessed July 15, 2012.
[149] Miller M. 2012. Wendy's commits to gestation-stall-free pork. Pork Magazine, March 26. www.porknetwork.com/e-newsletters/pork-daily/Wendys-commits-to-gestation-stall-free-pork-144153905.html. Accessed July 15, 2012.
[150] Gabbett RJ. 2012. Safeway announces plans toward gestation stall-free pork supply. Meatingplace, May 7. www.meatingplace.com/Industry/News/Details/32869. Accessed July 7, 2012.
[151] Smith R. 2012. Kroger asks for 'accelerated' move to stall-free pork. Feedstuffs, June 4. www.feedstuffs.com/ME2/dirmod.asp?sid=F4D1A9DFCD974EAD8CD5205E15C1CB42&nm=&type=news&mod=News&mid=A3D60400B4204079A76C4B1B129CB433&tier=3&nid=1D04E44282234E63B72D505BEA99C86F. Accessed July 15, 2012.
[152] 2012. Kroger Asks Suppliers to Accelerate Sow Housing Transition. Supermarket News, June 4. http://supermarketnews.com/meat/kroger-asks-suppliers-accelerate-sow-housing-transition. Accessed July 15, 2012.
[153] 2012. Oscar Mayer to eliminate gestation crates by 2022. Huffington Post, July 9. www.huffingtonpost.com/2012/07/09/oscar-mayer-gestation-crates_n_1658670.html. Accessed July 20, 2012.
[154] 2012. Oscar Mayer latest to scrap cramped quarters for sows. Chicago Tribune, July 6. www.chicagotribune.com/business/breaking/chi-oscar-mayer-latest-to-scrap-cramped-quarters-for-sows-20120706,0,2119171.story. Accessed July 20, 2012.
[155] Marchant JN and Broom DM. 1996. Effects of dry sow housing conditions on muscle weight and bone strength. Animal Science 62:105-13.
[156] Marchant JN and Broom DM. 1996. Effects of dry sow housing conditions on muscle weight and bone strength. Animal Science 62:105-13, citing: Marchant JN and Broom DM. 1993. The effects of dry sow housing conditions on lying behaviour of sows. In: M Nichelmann, Wierenga HK, and Braun S (eds.), Proceedings of the International Congress on Applied Ethology (KTBL, Darmstadt: pp. 455-458).
[157] European Commission. 1997. Report of the Scientific Veterinary Committee, Animal Welfare Section. The welfare of intensively kept pigs. Doc XXIV/B3/ScVC/0005/1997, p. 22. http://ec.europa.eu/food/fs/sc/oldcomm4/out17_en.pdf. Accessed July 8, 2012.
[158] European Commission. 1997. Report of the Scientific Veterinary Committee, Animal Welfare Section. The welfare of intensively kept pigs. Doc XXIV/B3/ScVC/0005/1997, p. 22. http://ec.europa.eu/food/fs/sc/oldcomm4/out17_en.pdf. Accessed July 8, 2012.

[159] Tillon JP and Madec F. 1984. Diseases affecting confined sows: data from epidemiological observations. Annales de Recherches Vétérinaires (Annals of Veterinary Research) 15(2):195-9.
[160] European Commission. 1997. Report of the Scientific Veterinary Committee, Animal Welfare Section. The welfare of intensively kept pigs. Doc XXIV/B3/ScVC/0005/1997, p. 93. http://ec.europa.eu/food/fs/sc/oldcomm4/out17_en.pdf. Accessed July 8, 2012.
[161] Tillon JP and Madec F. 1984. Diseases affecting confined sows: data from epidemiological observations. Annales de Recherches Vétérinaires (Annals of Veterinary Research) 15(2):195-9.
[162] Madec F. 1984. Urinary disorders in intensive pig herds. Pig News and Information 5(2):89-93.
[163] Tillon JP and Madec F. 1984. Diseases affecting confined sows: data from epidemiological observations. Annales de Recherches Vétérinaires (Annals of Veterinary Research) 15(2):195-9.
[164] Fredeen HT and Sather AP. 1978. Joint damage in pigs reared under confinement. Canadian Journal of Animal Science 58:759-73.
[165] Sather AP and Fredeen HT. 1982. The effect of confinement housing upon the incidence of leg weakness in swine. Canadian Journal of Animal Science 62:1119-28.
[166] Kornegay ET, Bryant KL, and Notter DR. 1990. Toe lesion development in gilts and sows housed in confinement as influenced by toe size and toe location. Applied Agricultural Research 5(4):327-34.
[167] Miller D. 2004. Sows flourish in pen gestation. National Hog Farmer, March 15.
[168] Stalder K and Baas T. 2005. Screen gilts for feet and leg disorders. National Hog Farmer, February 15.
[169] Anil L, Anil SS, and Deen J. 2002. Evaluation of the relationship between injuries and size of gestation stalls relative to size of sows. Journal of the American Veterinary Medical Association 221(6):834-6.
[170] Anil L, Anil SS, and Deen J. 2002. Evaluation of the relationship between injuries and size of gestation stalls relative to size of sows. Journal of the American Veterinary Medical Association 221(6):834-6.
[171] Webster J. 1994. Animal Welfare: A Cool Eye Towards Eden (Oxford, U.K.: Blackwell Science Ltd., p. 148).
[172] Marchant JN, Rudd AR, and Broom DM. 1997. The effects of housing on heart rate of gestating sows during specific behaviours. Applied Animal Behaviour Science 55:67-78.
[173] Commission of the European Communities. 2001. COM(2001) 20 final 2001/0021 (CNS) Communication from the Commission to the Council and the European Parliament on the welfare of intensively kept pigs in particularly taking into account the welfare of sows reared in varying degrees of confinement and in groups. Proposal for a Council Directive amending Directive 91/630/EEC laying down minimum standards for the protection of pigs.
[174] Dawkins MS. 1998. Through Our Eyes Only? The Search for Consciousness (Oxford, U.K.: Oxford University Press, pp. 156-7).
[175] Signoret JP, Baldwin BA, Fraser D, and Hafez ESE. 1975. The behaviour of swine. In: Hafez ESE (ed.), The Behaviour of Domestic Animals, 3rd Edition (London, U.K.: Baillibre Tindall, p. 300).
[176] Wright D. 2005. Was your meat smarter than your pet? Research suggests farm animals are surprisingly intelligent. ABC News, May 22. http://abcnews.go.com/WNT/Science/Story?id=771414. Accessed July 8, 2012.
[177] Špinka M, Duncan IJH, and Widowski TM. 1998. Do domestic pigs prefer short-term to medium-term confinement? Applied Animal Behaviour Science 58:221-32.
[178] Stolba A and Wood-Gush DGM. 1989. The behaviour of pigs in a semi-natural environment. Animal Production 48:419-25.
[179] Petersen V. 1994. The development of feeding and investigatory behaviour in free-ranging domestic pigs during their first 18 weeks of life. Applied Animal Behaviour Science 42:87-98.
[180] Stolba A and Wood-Gush DGM. 1989. The behaviour of pigs in a semi-natural environment. Animal Production 48:419-25.
[181] Cronin GM and Wiepkema PR. 1984. An analysis of stereotyped behaviour in tethered sows. Annales de Recherches Vétérinaires (Annals of Veterinary Research) 15(2):263-70.
[182] Mendl MT. 1991. The effects of alternative forms of intensive pig husbandry on measures of pig welfare. In: Bradley A and Sckofield WL (eds.), Proceedings of the First Association of Veterinary Students Animal Welfare Symposium (Cambridge, U.K.: Association of Veterinary Students).

[183] Mendl MT. 1991. The effects of alternative forms of intensive pig husbandry on measures of pig welfare. In: Bradley A and Sckofield WL (eds.), Proceedings of the First Association of Veterinary Students Animal Welfare Symposium (Cambridge, U.K.: Association of Veterinary Students).
[184] Broom DM and Johnson KG. 1993. Stress and Animal Welfare (London, U.K.: Chapman & Hall, p. 77).
[185] Broom DM, Mendl MT, and Zanella AJ. 1995. A comparison of the welfare of sows in different housing conditions. Animal Science 61:369-85.
[186] Maria Levrino GA and Villarroel Robinson M. 2003. Welfare status of commercial sows in three housing systems in Spain. Archivos de Zootecnia 52:453-62.
[187] Mendl MT. 1991. The effects of alternative forms of intensive pig husbandry on measures of pig welfare. In: Bradley A and Sckofield WL (eds.), Proceedings of the First Association of Veterinary Students Animal Welfare Symposium (Cambridge, U.K.: Association of Veterinary Students).
[188] Morris JR, Hurnik JF, Friendship RM, Buhr MM, and Allen OB. 1993. The behavior of gestating swine housed in the Hurnik-Morris system. Journal of Animal Science 71:3280-4.
[189] Vieuille-Thomas C, Le Pape G, and Signoret JP. 1995. Stereotypies in pregnant sows: indications of influence of the housing system on the patterns expressed by the animals. Applied Animal Behaviour Science 44:19-27.
[190] Broom DM, Mendl MT, and Zanella AJ. 1995. A comparison of the welfare of sows in different housing conditions. Animal Science 61:369-85.
[191] Vestergaard K. 1984. An evaluation of ethological criteria and methods in the assessment of well-being in sows. Annales de Recherches Vétérinaires (Annals of Veterinary Research) 15(2):227-36.
[192] Vestergaard K and Hansen LL. 1984. Tethered versus loose sows: ethological observations and measures of productivity. I. Ethological observations during pregnancy and farrowing. Annales de Recherches Vétérinaires (Annals of Veterinary Research) 15(2):245-56.
[193] Dawkins MS. 1988. Behavioural deprivation: a central problem in animal welfare. Applied Animal Behaviour Science 20(3/4):209-25.
[194] Mason GJ and Latham NR. 2004. Can't stop, won't stop: is stereotypy a reliable animal welfare indicator? Animal Welfare 13:S57-69.
[195] European Commission. 1997. Report of the Scientific Veterinary Committee, Animal Welfare Section. The welfare of intensively kept pigs. Doc XXIV/B3/ScVC/0005/1997, p. 88. http://ec.europa.eu/food/fs/sc/oldcomm4/out17_en.pdf. Accessed July 8, 2012.
[196] European Commission. 1997. Report of the Scientific Veterinary Committee, Animal Welfare Section. The welfare of intensively kept pigs. Doc XXIV/B3/ScVC/0005/1997, p. 88. http://ec.europa.eu/food/fs/sc/oldcomm4/out17_en.pdf. Accessed July 8, 2012.
[197] Task Force on the Housing of Pregnant Sows. 2005. A comprehensive review of housing for pregnant sows. Journal of the American Veterinary Medical Association 227(10):1580-90.
[198] Mason GJ and Latham NR. 2004. Can't stop, won't stop: is stereotypy a reliable animal welfare indicator? Animal Welfare 13:S57-69.
[199] Task Force on the Housing of Pregnant Sows. 2005. A comprehensive review of housing for pregnant sows. Journal of the American Veterinary Medical Association 227(10):1580-90.
[200] European Commission. 1997. Report of the Scientific Veterinary Committee, Animal Welfare Section. The welfare of intensively kept pigs. Doc XXIV/B3/ScVC/0005/1997, p. 97. http://ec.europa.eu/food/fs/sc/oldcomm4/out17_en.pdf. Accessed July 8, 2012.
[201] Honeyman M. 1996. Swine system options for Iowa. Outdoor pig production: an approach that works. Iowa State University. www.leopold.iastate.edu/sites/default/files/pubs-and-papers/1996-05-swine-system-options-iowa-outdoor-pig-production-approach-works.pdf. Accessed July 25, 2012.
[202] Broom DM, Mendl MT, and Zanella AJ. 1995. A comparison of the welfare of sows in different housing conditions. Animal Science 61:369-85.
[203] Honeyman MS. 1995. Västgötmodellen: Sweden's sustainable alternative for swine production. American Journal of Alternative Agriculture 10(3):129-32.
[204] Miller D. 2004. Sows flourish in pen gestation. National Hog Farmer, March 15.
[205] Gonyou HW. 2005. Experiences with alternative methods of sow housing. Journal of the American Veterinary Medical Association 226(8):1336-40.

[206] Pajor EA. 2005. Sow housing: science, behavior, and values. Journal of the American Veterinary Medical Association 226(8):1340-4.
[207] Lammers P, Honeyman M, Mabry J, and Harmon J. 2007. Sow and litter performance for individual crate and group hoop barn gestation housing systems: project summary. Iowa State University Animal Industry Report 2007. A.S. Leaflet R2236. www.ans.iastate.edu/report/air/2007pdf/R2236.pdf. Accessed July 8, 2012.
[208] European Commission. 1997. Report of the Scientific Veterinary Committee, Animal Welfare Section. The welfare of intensively kept pigs. Doc XXIV/B3/ScVC/0005/1997, p. 97. http://ec.europa.eu/food/fs/sc/oldcomm4/out17_en.pdf. Accessed July 8, 2012.
[209] U.S. Department of Agriculture, Food Safety and Inspection Service. 2006. Veal from farm to table. www.fsis.usda.gov/Fact_Sheets/Veal_from_Farm_to_Table/index.asp. Accessed July 8, 2012 .
[210] Keefe LM. 2008. The best of both worlds. Meetingplace, September, pp. 51-8.
[211] U.S. Department of Agriculture, Food Safety and Inspection Service. 2006. Veal from farm to table. www.fsis.usda.gov/Fact_Sheets/Veal_from_Farm_to_Table/index.asp. Accessed July 8, 2012.
[212] Wilson LL, Stull CL, and Terosky TL. 1995. Veal perspectives to the year 2000: scientific advancements and legislation addressing veal calves in North America. Proceedings of the International Symposium in Le Mans, France, September 12-13.
[213] Arizona Secretary of State's Office. 2006. Ballot Proposition Guide. Official Proposition 204 language. www.azsos.gov/election/2006/Info/PubPamphlet/Sun_Sounds/english/Prop204.htm . Accessed July 8, 2012.
[214] Colorado Enrolled Senate Bill 08-201 (2008) www.leg.state.co.us/clics/clics2008a/csl.nsf/fsbillcont3/15738AC63DFF2DB1872573E600643253?open&file=201_enr.pdf. Accessed July 8, 2012.
[215] California Health and Safety Code, Division 20, Chapter 13.8, Farm Animal Cruelty, Section 25990-25994. http://codes.lp.findlaw.com/cacode/HSC/1/d20/13.8. Accessed July 25, 2012.
[216] California Proposition 2 (2008) www.sos.ca.gov/elections/sov/2008_general/maps/returns/props/prop-2.htm. Accessed July 8, 2012.
[217] Maine Public Law. 2009. Chapter 127, An act to prohibit cruel confinement of calves raised for veal and sows during gestation. www.mainelegislature.org/legis/bills/bills_124th/chapters/PUBLIC127.asp. Accessed July 12, 2012.
[218] Michigan Enrolled House Bill 5127 (2009) www.legislature.mi.gov/documents/2009-2010/billenrolled/House/pdf/2009-hNB-5127.pdf. Accessed July 8, 2012.
[219] Ohio Department of Agriculture. Administrative code 901:12-5, Livestock care standards, bovine-veal. www.agri.ohio.gov/LivestockCareStandards/docs/Livestock%20Care%20Standards%20(EFFECTIVE).pdf. Accessed July 7, 2012
[220] Salvage B. 2006. Revolutionizing the veal industry. Meat Processing, December, pp. 14-21.
[221] Storck AB. 2007. Veal processor switches to new calf-housing system. Meatingplace.com, January 29.
[222] Salvage B. 2006. Revolutionizing the veal industry. Meat Processing, December, pp. 14-21.
[223] Smith R. 2007. Veal group housing approved. Feedstuffs, August 6, p. 3.
[224] Keefe LM. 2012. Veal industry records progress in group housing. Meatingplace, May 10. www.meatingplace.com/Industry/News/Details/32957. Accessed May 10, 2012.
[225] Wilson LL, Stull CL, and Terosky TL. 1995. Veal perspectives to the year 2000: scientific advancements and legislation addressing veal calves in North America. Proceedings of the International Symposium in Le Mans, France, September 12-13.
[226] European Commission, Scientific Veterinary Committee, Animal Welfare Section. 1995. Report on the welfare of calves. Adopted November 9. http://ec.europa.eu/food/fs/sc/oldcomm4/out35_en.pdf. Accessed July 8, 2012.
[227] Van Putten G. 1982. Welfare in veal calf units. The Veterinary Record 111(19):437-40.
[228] Friend TH and Dellmeier GR. 1988. Common practices and problems related to artificially rearing calves: an ethological analysis. Applied Animal Behaviour Science 20(1/2):47-62.
[229] European Commission, Scientific Veterinary Committee, Animal Welfare Section. 1995. Report on the welfare of calves. Adopted November 9. http://ec.europa.eu/food/fs/sc/oldcomm4/out35_en.pdf. Accessed July 8, 2012.

[230] European Commission, Scientific Veterinary Committee, Animal Welfare Section. 1995. Report on the welfare of calves. Adopted November 9. http://ec.europa.eu/food/fs/sc/oldcomm4/out35_en.pdf. Accessed July 8, 2012.
[231] Broom DM. 1991. Needs and welfare of housed calves. In: Metz JHM and Groenestein CM (eds.), New Trends in Veal Calf Production (Wageningen, The Netherlands: EAAP Publications, pp. 23-31).
[232] European Commission, Scientific Veterinary Committee, Animal Welfare Section. 1995. Report on the welfare of calves. Adopted November 9. http://ec.europa.eu/food/fs/sc/oldcomm4/out35_en.pdf. Accessed July 8, 2012.
[233] Jensen MB. 1999. Effects of confinement on rebounds of locomotor behaviour of calves and heifers, and the spatial preferences of calves. Applied Animal Behaviour Science 62(1):43-56.
[234] Jensen MB, Vestergaard KS, and Krohn CC. 1998. Play behaviour in dairy calves kept in pens: the effect of social contact and space allowance. Applied Animal Behaviour Science 56(2/4):97-108.
[235] Friend TH. 1991. Symposium: Response of animals to stress (Behavioral aspects of stress). Journal of Dairy Science 74(1):292-303.
[236] Friend TH and Dellmeier GR. 1988. Common practices and problems related to artificially rearing calves: an ethological analysis. Applied Animal Behaviour Science 20(1/2):47-62.
[237] Flower FC and Weary DM. 2003. The effects of early separation on the dairy cow and calf. Animal Welfare 12(3):339-48.
[238] European Food Safety Authority. 2006. Scientific opinion on the risks of poor welfare in intensive calf farming systems. An update of the Scientific Veterinary Committee report on the welfare of calves. Adopted May 24, 2006. The EFSA Journal 366:1-36. www.efsa.europa.eu/en/efsajournal/doc/366.pdf. Accessed July 25, 2012.
[239] Holm L, Jensen MB, and Jeppesen LL. 2002. Calves' motivation for access to two different types of social contact measured by operant conditioning. Applied Animal Behaviour Science 79(3):175-94.
[240] Holm L, Jensen MB, and Jeppesen LL. 2002. Calves' motivation for access to two different types of social contact measured by operant conditioning. Applied Animal Behaviour Science 79(3):175-94.
[241] Friend TH and Dellmeier GR. 1988. Common practices and problems related to artificially rearing calves: an ethological analysis. Applied Animal Behaviour Science 20(1/2):47-62.
[242] Friend TH and Dellmeier GR. 1988. Common practices and problems related to artificially rearing calves: an ethological analysis. Applied Animal Behaviour Science 20(1/2):47-62.
[243] Friend TH, Dellmeier GR, and Gbur EE. 1985. Comparison of four methods of calf confinement: I. Physiology. Journal of Animal Science 60(5):1095-101.
[244] Stull C and Reynolds J. 2008. Calf welfare. Veterinary Clinics of North America: Food Animal Practice 24(1):191-203.
[245] Friend TH and Dellmeier GR. 1988. Common practices and problems related to artificially rearing calves: an ethological analysis. Applied Animal Behaviour Science 20(1/2):47-62.
[246] Friend T. 1989. Testimony on the Veal Calf Protection Act (H.R. 84) before a joint hearing of the Subcommittee on Livestock, Dairy, and Poultry; and the Subcommittee on Department Operations, Research, and Foreign Agriculture. June 6, p. 36.
[247] Council of Europe. 1997. Council Directive 97/2/EC of 20 January 1997 amending Directive 91/629/EEC laying down minimum standards for the protection of calves.
http://ec.europa.eu/food/fs/aw/aw_legislation/calves/97-2-ec_en.pdf. Accessed July 8, 2012.
[248] European Commission. 1997. Commission Decision of 24 February 1997 amending the Annex to Directive 91/629/EEC laying down minimum standards for the protection of calves (Text with EEA relevance) (97/182/EC). http://ec.europa.eu/food/fs/aw/aw_legislation/calves/97-182-ec_en.pdf. Accessed July 8, 2012.
[249] European Commission, Scientific Veterinary Committee, Animal Welfare Section. 1995. Report on the welfare of calves. Adopted November 9. http://ec.europa.eu/food/fs/sc/oldcomm4/out35_en.pdf. Accessed July 8, 2012.
[250] Andrighetto I, Gottardo F, Andreoli D, and Cozzi G. 1999. Effect of type of housing on veal calf growth performance, behaviour and meat quality. Livestock Production Science 57(2):137-45.

[251] European Commission, Scientific Veterinary Committee, Animal Welfare Section. 1995. Report on the welfare of calves. Adopted November 9. http://ec.europa.eu/food/fs/sc/oldcomm4/out35_en.pdf. Accessed July 8, 2012.
[252] Gentle M and Wilson S. 2004. Pain and the laying hen. In: Perry GC (ed.), Welfare of the Laying Hen (Wallingford, U.K.: CAB International).
[253] Gentle MJ. 1992. Pain in birds. Animal Welfare 1:235-47.
[254] Weary DM, Niel L, Flower FC, and Fraser D. 2006. Identifying and preventing pain in animals. Applied Animal Behaviour Science 100(1-2):64-76.
[255] Panksepp J. 2005. Beyond a joke: from animal laughter to human joy? Science 308(5718):62-3.
[256] Burgdorf J and Panksepp J. 2006. The neurobiology of positive emotions. Neuroscience and Biobehavioral Reviews 30(2):173-87.
[257] Smithfield Foods. 2007. Smithfield Foods makes landmark decision regarding animal management. Press release issued January 25. www.prnewswire.com/news-releases/smithfield-foods-makes-landmark-decision-regarding-animal-management-53754097.html. Accessed July 8, 2012.
[258] Stewart J. 2007. Maple Leaf to phase out sow gestation stalls. The Star Phoenix, February 1. www.canada.com/saskatoonstarphoenix/news/business/story.html?id=dff218dc-2667-4996-8392-dbfde43c13d6. Accessed July 8, 2012.
[259] Storck AB. 2007. Veal processor switches to new calf-housing system. Meatingplace.com, January 29.
[260] Glenn J. 2007. Roamin' chickens hatch big profits: poultry market expands for organic, cage-free eggs. The Journal Gazette, September 10. www.journalgazette.net/apps/pbcs.dll/article?AID=/20070910/BIZ/709100353. Accessed July 8, 2012.
[261] Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America. www.ncifap.org/_images/PCIFAPFin.pdf. Accessed July 8, 2012.