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Animal Welfare as Related to Egg Production Systems:

Cage and Non-Cage/Alternative Systems (Barns, Aviaries, Free-Range)

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Limited Comparisons Exist

Limited scientific data exists comparing the welfare of laying hens kept in cages and non-cage (alternative) housing systems. As a result, very little evidence is available to support the assumption that welfare is enhanced (or poorer) in one system or the other (see a recent review by Rodenburg *et al.,* 2005). Furthermore, all systems of housing have their own inherent problems.

Although some farmers can manage non-cage systems to a standard similar to that of cage systems, generally more problems exist in non-cage systems. Also, as there is no evidence that non-cage systems are superior for bird welfare, the issue becomes predominantly an ethical one of what society perceives as appropriate.

Three common commercial egg-production systems are in use around the world. These systems are:

- Cages — Birds are in cages in either environmentally controlled or open-fronted sheds.
- Free-range — Birds are loose-housed and have daily access to the outdoors. The range of housing can be highly variable but may be similar to that used for barn production.
- Barns — Birds are loose-housed on litter but have no access to the outdoors. Barn houses also have nest boxes and a dust-bath area and may be single-tiered or multi-tiered (aviaries).

More recently in Europe, furnished cages have also been developed; these cages include a nest box, dust bath, and perch.

Physiological Indicators

A number of experiments have examined a range of physiological variables indicative of stress associated with cage/pen effects. Based on literature on corticosterone (a stress hormone) concentrations in cage and non-cage

systems, no unequivocal evidence exists that extent of confinement *per se* has any consequences for the welfare of the laying hen.

For example, corticosterone concentrations were similar in cages and outside range pens, while corticosterone concentrations in floor pens can be greater, lesser, or not different than in some cages (see Barnett and Hemsworth, 2003). In part, these differences appear to depend on the space allowance and/or group size of birds in cages. Hence, there is little evidence to indicate that the welfare of laying hens in conventional cages is at a greater risk than that of birds in free range, open pen, or barn systems.

Air Quality May Affect Health, Hygiene, Food Safety, and Workers

Air quality is often poorer in alternative housing systems, and this can affect health and hygiene, which is relevant not only for hen welfare but also for food safety.

The large amount of litter and the greater bird movement in alternative systems result in greater concentrations of bacteria and fungi in the air and in greater dust concentrations compared with conventional and furnished cage systems. Greater dust concentrations have been associated with more serious pulmonary lesions, typical of chronic bronchitis, in cage-free birds (Michel and Huonnic, 2003).

The increased dust concentrations in alternative housing systems also raise human health concerns, as a stronger inflammatory reaction and increased bronchial responsiveness have been found in humans who work in alternative systems, compared with humans who work in conventional cage systems (Larsson *et al.,* 1999).

Emission rates of ammonia are also greater for alternative systems than for cage systems, and greater concentrations of ammonia in the air can also cause problems. Research has shown that birds can detect ammonia in the air and show an aversion to it, preferring fresh air over air with 25 or 45 ppm ammonia when given a choice (Kristensen *et al.,* 2000).

Greater concentrations of ammonia may lead to welfare and health problems, both for the animals and the caretakers. For poultry, chronic exposure to ammonia increases susceptibility to respiratory pathogens and may lead to impaired performance and eye problems. For humans, greater amounts of endotoxin, ammonia, and dust contribute to acute and chronic respiratory symptoms in farm workers (Von Essen and Donham, 1999).

Bone Strength, Injuries, and Mortality

In general, although bone strength is improved in non-cage systems, weak bones and bone breakage remain major issues across all housing systems. Thus, although housing hens in cage-free environments generally improves bone strength and hence reduces the incidence of broken bones that occur as a result of handling and transport, factors other than housing may have a more important role.

In fact, in alternative systems where perches are provided, birds may actually injure themselves and even break bones when they attempt to land on but miss the perch. Hence, access to perches in alternative housing systems may actually lead to broken bones. After depopulation (removal of birds for harvesting), previous evidence of bone breaks (due to the housing system) were found in 25% of birds from a cage-free housing system, whereas only 5% of caged hens had evidence of previous bone breaks (Gregory *et al.,* 1990).

Furthermore, even for birds reared on the floor with access to perches and then housed in an aviary system (multiple tiers), bone strength was still reduced compared to birds that spent their entire life in an aviary system (Michel and Huonnic, 2003), highlighting that bone strength can still be compromised even in non-cage systems.

The rate of injuries has been found to be greater in cage-free than cage systems (Michel and Huonnic, 2003). Also, limited immunological data suggest that birds in floor pens may be relatively immuno-compromised (Erhard *et al.,* 2000). Similarly, mortality is greater in non-cage systems than cage housing systems (Michel and Huonnic, 2003). Non-cage systems, particularly free-range outdoor systems, also pose additional biosecurity risks and increased risk of predation. Cage systems help ensure a more controlled and comfortable temperature for the birds.

It is naïve to believe that we could take hens from small groups in cages and house them in extremely large groups and not expect serious problems to occur. In alternative housing systems, where hens may be kept in enormous flocks (10,000+ birds in one barn), increased feather-pecking and increased cannibalism often result (Nicol *et al.,* 1999; Bilcík and Keeling, 2000).

Within very large flocks, there is also likely to be a subclass of birds that has very poor welfare, due to bullying from other birds, and hence are prevented from feeding and have an enhanced fear of other birds. In large, free-range groups of hens, variation in spatial distribution (density) over the system is found, where extremely high stocking densities in specific areas of the pen can result in birds suf-

focating when other birds pile on top of them (Channing *et al.,* 2001; Michel and Huonnic, 2003).

Conclusion

The United Egg Producers Certified Program (under which 85% of the eggs in the United States are produced) has adopted a five-year plan to increase the space allowance in conventional cages. Furthermore, the industry is continuing to research and develop furnished cages, where hens have more space than in conventional cages and have access to a nest, a perch, and an area with some litter for pecking, scratching, and dust-bathing.

In addition, the European Union will be adopting furnished cages in 2012, and thus eggs are likely to continue to be produced from caged hens. The industry is continuing to investigate enhanced ways of housing hens, while still being able to produce safe and affordable eggs for consumers.

In conclusion, studies on the stress physiology, bone strength and fractures, immunology, and mortality of laying hens indicate that hen welfare is not enhanced in non-cage housing systems. While the hen's behavioral repertoire is increased in non-cage systems, the implications of this for welfare are unclear. As with all systems, some of the disadvantages (or perceived disadvantages) of conventional cages can be overcome by close attention to the design of the cage and management of the system.

Research is continuing to improve welfare across the range of hen production systems, but while this continues, individuals need to become informed on the issues and form their own opinions on the adequacy or otherwise of current systems of egg production (and other issues involving the use of animals). In this way, individuals can participate in a rational debate on animal welfare and contribute to providing guidance to the industry on consumer and community needs and expectations.

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