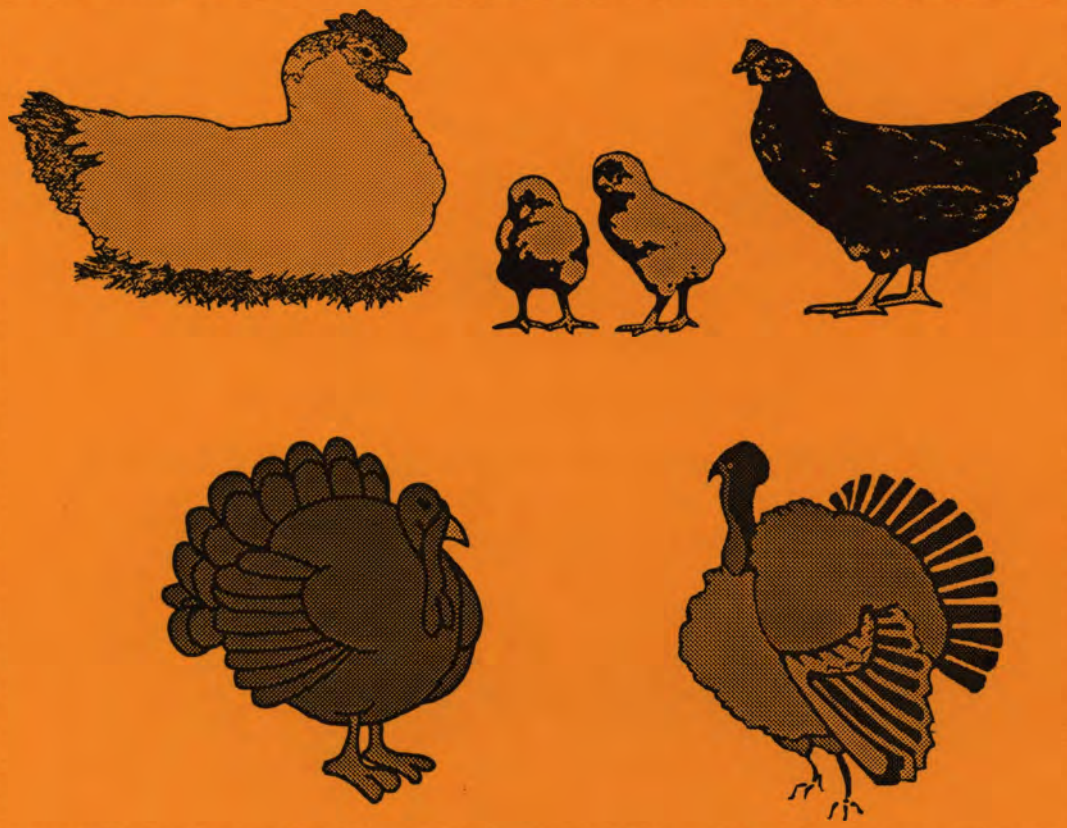
American Association of Avian Pathologists

Symposium on Poultry Management and Production



July 11, 1999

New Orleans, Louisiana

SYMPOSIUM ON POULTRY MANAGEMENT AND PRODUCTION

42nd Annual Meeting of the
American Association of Avian Pathologists

July 11, 1999

New Orleans, Louisiana

VETERINARIAN'S OATH

Being admitted to the profession of veterinary medicine,

I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health, the relief of animal suffering, the conservation of livestock resources, the promotion of public health, and the advancement of medical knowledge.

I will practice my profession conscientiously, with dignity, and in keeping with the principles of veterinary medical ethics.

I accept as a lifelong obligation the continual improvement of my professional knowledge and competence.

Adopted by the AVMA in July, 1969

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ABOUT THE SYMPOSIUM

The Animal Welfare and Management Practices Committee of the American Association of Avian Pathologists (AAAP) is composed of representatives from industry and academia, who believe that the issues associated with poultry welfare in the US will have increasing public and economic significance. This committee was formed to gather and provide critical information to the Board of Directors and the membership of the AAAP on issues related to poultry production and welfare. Some members of this committee also serve as liaison with the Animal Welfare Committees of the American Veterinary Medical Association (AVMA) and the Poultry Science Association (PSA).

In the last few years, the committee has taken a proactive role in sharing information and increasing the awareness of veterinarians and scientists on issues that may have an impact on the responsible management of poultry in commercial operations and research institutions. As part of this role, the committee initiated efforts to organize this symposium and selected a roster of very knowledgeable and internationally recognized veterinarians and poultry scientists. The program addresses the roles and synergies of the veterinary profession and other scientific disciplines associated with poultry production and research. Also, it presents different perspectives on the current and future impact of animal welfare issues for commercial poultry operations and research institutions. We hope it will provide a forum for positive discussions with representatives from agricultural and poultry organizations.

We thank our sponsors and all individuals who worked in planning and coordinating this event. We hope that the information presented and the material included in the proceedings becomes a valuable reference for all the participants and attendees.

Symposium Co-Chairs

Marion Hammarlund

Gregorio Rosales

Teresa Morishita

ANIMAL WELFARE AND MANAGEMENT PRACTICES COMMITTEE

Mission Statement

To research and provide critical information to the AAAP Board of Directors and the membership on animal welfare issues that may have a bearing on this body and to be a liaison between the AAAP membership and the AVMA Animal Welfare Committee.

Goals

To take a proactive role in providing the AAAP Board of Directors and the membership with information on the responsible handling of animals within the poultry industries as well as other animal welfare issues.

To produce some "public service" information on the responsible handling of animals characterized by the membership of the AAAP.

Committee Members, 1998-1999

M.A. Hammarlund, Chair
Max Brugh
Donna Carver
Frank Edens
Doug Erbeck
Colleen Home
Jeff Kula
Jose Linares
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Teresa Morishita
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George Rowland
Michael Ruff
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Brian Wooming

Symposium on Poultry Management & Production

Sunday, July 11, 1999

Moderators: Dr. Gregorio Rosales and Dr. George N. Rowland

8:00 a.m. Welcome
Dr. Yan Ghazikanian, President
American Association of Avian Pathologists

8:05 a.m. Introduction of Symposium
Dr. Marion A. Hammarlund, Chair
AAAP Animal Welfare and Management Practices Committee

SYNERGISM AMONG THE DISCIPLINES

8:10 a.m. The Leadership Role of the Veterinarian in Food Animal Welfare
Dr. Frank M. Loew

8:40 a.m. Poultry Well-being: Synergy of Research, Industry and Avian Medicine
Dr. Anthony J. Pescatore

9:10 a.m. Poultry Welfare: A Meeting of Science and Sensibility
Dr. Joy A. Mench

9:30 a.m. Open discussion with all speakers from the first morning session

9:40 a.m. **BREAK (9:40-10:00)**

RAMIFICATIONS FOR THE INDUSTRY AND POULTRY VETERINARIANS

Moderators: Dr. John E. McCarty and Dr. Hugo A. Medina

10:00 a.m. Current State of Poultry Welfare in the European Community
Dr. Mark Pattison

10:40 a.m. Genetics and Behavior in Poultry
Dr. Paul B. Siegel

11:00 a.m. The Role of the Poultry Veterinarian in Welfare Issues
Dr. William B. Chase

11:20 a.m. Maintenance of the Well-Being of Poultry: Proactive Training or Regulations?
Dr. Richard D. Reynnells

11:40 a.m. Open discussion with all speakers from the second morning session

11:50 **LUNCH (11:50-1:20)**

AN INDUSTRY SEGMENT PERSPECTIVE

Moderator: Dr. Jose A. Linares and Dr. Douglas H. Erbeck

1:20 p.m. Broiler Production Welfare Issues
Dr. Henry L. Classen

1:50 p.m. Addressing Welfare Issues - A Breeder's Perspective
Dr. John T. Brake

2:10 p.m. Turkey Production: Maximizing Comfort and Production
Dr. Sally L. Noll

2:30 p.m. Economic Implications of Controversial Layer Management Programs
Mr. Donald D. Bell

2:50 p.m. Open discussion with all speakers from the first afternoon session

3:00 p.m. **BREAK (3:00 - 3:20)**

AN INDUSTRY ASSOCIATION PERSPECTIVE

Moderators: Dr. John H. Schleifer and Dr. Jeff Kula

3:20 p.m. Perspective from the United Egg Producers
Dr. Albert E. Pope

3:40 p.m. Advancing America's Animal Agriculture
Mr. Steven L. Kopperud

4:00 p.m. U.S. Poultry and Egg Association
Dr. Charles W. Beard

4:20 p.m. Open discussion with all speakers from the second afternoon session

4:30 p.m. Closing Remarks
Dr. Charles W. Beard

4:40 p.m. **ADJOURN**

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Special thanks are extended to the speakers who generously agreed to share their expertise with the AAAP membership. We also thank the program moderators for agreeing to lead the presentation and discussion sessions, Dr. Robert Eckroade, Dr. Jagdev Sharma and Kimberly Sprout for providing advice and logistical support, Cindy Cheely of the Ohio State University Extension - Veterinary Medicine for general clerical support and valuable assistance in preparing the proceedings, and Rebecca Dodson of Omnipress for her assistance in printing the proceedings.

SYNERGISM AMONG THE DISCIPLINES

Morning Session
8:10 - 9:40

Speakers in this Session

Dr. Frank M. Loew
Dr. Anthony J. Pescatore
Dr. Joy A. Mench

THE LEADERSHIP ROLE OF THE VETERINARIAN IN FOOD ANIMAL WELFARE

Franklin M. Loew, D.V.M., Ph.D.
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Chairman, Medical Foods, Inc.
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Though its origins were principally utilitarian, American veterinary medicine has always embraced both agriculture and medicine. James Law, the first university professor of veterinary medicine in the U.S., wrote (1876) that

> "...the great pecuniary interest in live stock is largely at the mercy of ignorant pretenders, whose barbarous surgery is only equaled by their reckless and destructive drugging. The constantly recurring instances of absolute and painful poisoning, and cruel and injurious vivsections practiced under the name of remedial measures are almost sickening to contemplate..."

And our profession greatly improved the care of farm animals in the late 19th and most of this century.

But something changed in the 1960's, first with the publication in England of Animal Machines, aimed squarely at the poultry industry, then in the 1970's with the publication of Animal Liberation.

The social commentary and activism on behalf of animals since then is well known. One of the most interesting outcomes of all this has been reinforcement of veterinary medicine's professional primacy in animal welfare by the public and the profession both.

Continued leadership in food animal welfare will require our professional associations and individual veterinarians to be responsive to public and political concerns while at the same time encouraging our industry to "do the right thing".

POULTRY WELL BEING: SYNERGY OF RESEARCH, INDUSTRY AND AVIAN MEDICINE

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ABSTRACT

The poultry industry, researchers and avian veterinarians have always made contribution to the well being of poultry. The well being of poultry includes the satisfaction of basic physical needs and the encouragement of necessary behaviors. The physical needs include food, water, shelter, health, safety and actual existence. The fact that these are physical needs indicate that they can be measured through various traits. The behavioral needs are more subjective and difficult to determine. The problems are becoming increasingly harder to define and solve in the area of animal well being. There will be a need for increased cooperation between producers, researchers and avian veterinarians to solve these problems.

The well being of animals is not a new topic. As part of man's relationship to animals, the well being of animals was necessary for the survival of both. Domestic animals, including poultry, exist to serve a purpose of man, whether it is for food, clothing, companionship, entertainment, aesthetics or work. The fact that domesticated animals are dependent on man for their existence also places the responsibility for their well being on man.

What constitutes the well being of poultry is a topic that has been and will be debated for years. If the emotional issues, the alternative agendas and the misinformation can be removed and the debate center on science, then we can begin to understand the factors necessary for the well being of poultry. The well being of poultry includes the satisfaction of basic physical needs and the encouragement of necessary behaviors. What these needs and behaviors are has always been the question.

The physical needs include food, water, shelter, health, safety and actual existence. The fact that these are physical needs indicate that they can be measured through various traits. Growth standards and production goals can be used to determine how well we are meeting the physical needs of the animals.

The behavioral needs are more subjective and difficult to determine. There is no direct measurement of a positive emotional state of poultry (Duncan 1998). The emotional state must be indirectly determined by the absence of negative states or states of suffering. The absence of fear, frustration and pain become the indirect measurements of a positive emotional state. This lack of a direct measurement of a positive emotional state is where the debate begins.

In order to succeed in the future, we sometimes need to reflect on the past. There is a movement that feels that modern poultry production does not meet the physical and behavior needs of birds as well as when it was less intensive. Lentz (1923) described the diseases and problems in a flock of 1500 laying hens raised on eight acres at the Massachusetts Agricultural Farm. A total of 356 hens were examined and 39 different problems were identified. The occurrence in individuals of the most prevalent problems were Ascardia (55), Heterakis (71), Ascites (5), Coccidiosis (44), Visceral Gout (39), Digestive tract impaction (17), Leg weakness (7), Peritonitis (31), Pneumonia and roup (56), Tumors (11), and Mutilation due to feather picking and cannibalism (33). Many of the problems have been solved over the last 75 years but it is interesting that some of these problems are still with us.

As we try to meet the physical and behavior needs of poultry, we must remember that as we fulfill one need we may impact our ability to meet other needs. Just as the poultry industry is dynamic and ever changing, animal well being is a dynamic process. The solution to the questions will not come easy; it will require the cooperative effort of the poultry industry, researchers and avian veterinarians. This is not new. Most of the major achievements in the well being of poultry have been the result of a cooperative effort of these three groups.

If we examine each of the physical needs of poultry and the accompanying issues, we can then begin the process to develop cooperative efforts to solve these problems. The ability to obtain food is a basic need. The nutrient requirements for poultry are well established (NRC 1998). The question is no longer the quality of food as was the main concern in the first half of the century but the quantity and frequency that feed must be provided to poultry. Food deprivation during some management programs is one of the most concerning issues in this area. Are we compromising the bird's well being during periods of food deprivation or does the bird have the ability to compensate, as would be the case when birds display nesting and brooding behavior (Ruszler 1998)?

Water is a need that is addressed in quality, quantity and delivery system. Advances in water delivery systems such as nipple drinkers have impacted not only the quality of the water but have impacted the quality of the birds environment through less water spillage, less litter moisture, and ultimately less ammonia. Providing cleaner water through a close system instead of an open system impacts the bird's health. The behavior needs are also impacted due to the compatibility of the nipple drinker to the birds drinking behavior. In addition, where a nipple drinker is placed in a cage can impact bird behavior. Current issues in meeting the water needs of poultry include water deprivation under some management systems and during transportation.

Shelter is one of the most debated topics. The purpose of shelter is to protect the birds from adverse environmental conditions and predators. How the shelter is provided has been the subject of many debates. There is no one perfect housing and management system. Each system has advantages and disadvantages. Cages have been be targeted by some groups as being against the welfare of the bird (FAWC 1986). However, Appleby (1998) indicates that cages have advantages over other alternative systems because the birds are keep in small groups (less aggression) and out

of contact with feces that reduces the incidence of disease. He further stated that cages have economic advantages. With cages the physical needs can be quantified, unfortunately the behavioral needs within the system will continue to be debated. The debate is not what the cage looks like, but rather what behaviors are necessary for a positive emotional state. If we answer the latter then the former will answer itself.

Health is the area that has showed the greatest examples of synergy between producers, researchers and avian veterinarians. There have been no greater challenges to the well being of poultry in the last century than disease concerns. Salmonella pullurom, Marek' s Disease and Avian Influenza are just a few of the diseases that have threatened the very existence of the poultry industry. The cooperative efforts of the poultry industry, researchers and avian veterinarians have helped to control these diseases and ultimately impact the well being of the bird. Advances in pharmaceuticals, vaccines, vaccine administration, diagnostic techniques and biosecurity have all contributed to this success. There are still numerous disease and health issues that impact the well being of poultry. The answers to these issues will come through cooperation.

Safety means to ensure the well being of the bird by protecting the bird from predators, trauma and injury. The sources of injury and trauma must be identified if improvements are to occur. Design of facilities, worker behavior, handling and transportation methods are all areas that need attention (Mench and Duncan 1998). A controversial issue in meeting the safety needs of poultry is beak trimming. The control of beak inflicted injuries justifies the procedure but that does not eliminate investigating alternative methods for controlling this problem. The problem of beak inflicted injuries is not new as indicated by Lentz (1923), who in a previously mentioned study concluded that vicious habits (feather picking and cannibalism) will rapidly become quite general in a flock and cause heavy losses. His recommendation was for immediate execution of birds that display this behavior. Beak trimming would have been a welcome alternative back then. With the cooperation between producers, researchers and avian veterinarians, viable alternatives will be found.

The need to exist is the fundamental need, for if the bird did not exist, then the other needs are irrelevant. Through breeding and selection programs, humans have impacted the appearance, the behavior, and the structure of domesticated birds. Many of the changes have had positive impacts on the well being of the bird, while other changes have had a negative impact. As the bird changes, how we meet its needs also changes. Producers, researchers and avian veterinarians must work with geneticists to determine the impact of selection on animal well being.

How we met the bird's behavioral needs is more difficult than meeting the physical needs. Duncan (1998) has indicated that there are twelve behavioral systems that include feeding behavior, drinking behavior, preening behavior, dust bathing behavior, maintenance behavior, sleeping behavior, locomotion behavior, sexual behavior, nesting behavior, brooding behavior, social interactions and response to predators. Which of these behaviors are necessary for a positive emotional state for poultry is what makes for lively debates and emotional reactions. In evaluating a production system you must first ask what behaviors can occur in this system and if it

can not occur what are the consequences. Duncan (1998) indicates that feeding, drinking and preening behaviors are all essential and some form of these behaviors are allowed in all production systems. However, in the case of sleep behavior the bird may have to adapt its behavior to fit the production system such as broilers in long light periods or layers in the absence of perches. Other behaviors can be completely absent such as sexual behavior in hens in the absence of males. There are many questions that need to be answered in regards to meeting the behavioral needs of poultry; this is one area that producers, researchers and avian veterinarians working together can have a synergetic effect. All three parties have a different prospectus on this issue and a cooperative effort may be what is needed to solve these issues.

The poultry industry, researchers and avian veterinarians have always made contribution to the well being of poultry. As the problems become increasingly harder to define and solve in this area there will be a need for increased cooperation between producers, researchers and avian veterinarians.

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POULTRY WELFARE: A MEETING OF SCIENCE AND SENSIBILITY

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Since the publication of Peter Singer's book *Animal Liberation* in 1975, animal ethics has emerged as a distinct (although still minor) field within philosophy. The increased interest in animal ethics among philosophers parallels a general public shift in attitude towards animals, a phenomenon that Rollin (1995) refers to as the "new social ethic" for animals. This new ethic has far-reaching implications for animal agriculture. Current animal production practices and new production technologies that are perceived to have negative effects on animal welfare are coming under increasing scrutiny, and in many European countries more intensive production methods are now gradually being abandoned in favor of so-called "animal friendly" (usually meaning extensive or semi-extensive) systems.

Institutionalized concern for animals is a relatively new phenomenon, and one that has arisen concomitantly with the increasing affluence and urbanization of people in developed countries (Rowan, 1989). The first national laws that explicitly protected animals were not passed until the 19th century, in England (Ryder, 1989). At this same time in the United States many states passed anti-cruelty laws protecting animals from abuse and neglect (Francione, 1995). The movement for the protection of animals languished in the early part of the 20th century, but underwent a revival mid-century. The outcome of this revival has been that all developed countries now have laws regulating animal experimentation, and all (except the U.S.) also have some official system of oversight or regulation of the on-farm treatment of agricultural animals.

Changes in the way in which animals are treated under the law are also evident. Traditionally animals have been legally classified as personal property, as they were under English Common Law. But, as Lessley (1991) points out, the legal system has gradually shifted towards a stance of providing animals themselves with some legal protection that goes above and beyond the protection of property. More significantly, perhaps, Europe last year accorded animals a new legal status distinct from either property or persons, that of "sentient beings". Although the ramifications of this change are not yet clear, it does accord with our intuitive sense that animals occupy some intermediate status between humans and inanimate property with respect to our ethical obligations to them.

What is it about animals that might entitle them to such intermediate status? There has been much discussion (and some disagreement) about the kinds of characteristics that make individuals objects of moral concern. Characteristics that we recognize in other people as conferring moral status include their ability to experience pain, suffering, and pleasure, and also include the fact that they have goals, expectations, and social relationships that are meaningful to them. In other words, people have interests in having or avoiding certain kinds of experiences, and these interests

can be satisfied or thwarted. Scientific studies have now demonstrated that there are many anatomical, physiological and behavioral similarities between humans and (at least) vertebrate animals, and these suggest that animals too have at least some of these interests. For instance, most people now accept (although this was certainly not always the case) that vertebrate animals can experience pain and distress, and believe that we have a corresponding moral obligation to alleviate that pain and distress if possible when it is caused by our actions.

It would, of course, be an oversimplification to suggest that most people take a completely reasoned ethical approach towards their decisions about how to treat animals. In fact, our attitudes towards particular animals are shaped by many personal factors that sometimes have little to do with logic, including how similar we perceive those animals to be to us, their "attractiveness", their usefulness, and their rarity (Burghardt and Herzog, 1989). But even given the anomalies this creates in policy, it is obvious that people in our society are increasingly concerned about the treatment of animals. There is still a broad-based acceptance that using animals for human benefit is appropriate. However, it is also clear that this acceptance is no longer unreserved. Numerous public opinion polls have found that approximately 80% of people in the U.S. believe that animals have rights (Hoban and Kendall, 1993; Craig and Swanson, 1994). This belief seems to encompass the following views:

- That animals have certain interests that need to be considered and respected
- That animal pain and suffering should be minimized or avoided whenever possible
- That animals cared for by humans deserve to have some quality of life that goes beyond the minimization of pain and suffering
- That animals should only be used for sufficiently important reasons (that is, that the costs and benefits of animal use should be fairly weighed, with due consideration for the animal's interests)
- That important animal interests should be protected legally

I think that most people in our society would agree with these statements, regardless of their interpretation of the phrase "animal rights". However, there is also considerable disagreement about each of these sentiments. Legitimate controversies arise as to which animal interests deserve consideration, how much pain and suffering is permissible, what elements constitute a quality of life for animals, and how animal interests should be weighed against human interests. It is precisely these questions that philosophers interested in animal issues have begun to address (e.g. Carruthers, 1992; DeGrazia, 1996; Frey, 1980; Midgely,1983; Singer, 1975; Rachels, 1990; Regan, 1983; Rollin, 1989; Sapontzis, 1997; Varner, 1998). There are also questions that Institutional Animal Care and Use Committee members and others involved in animal care and use wrestle with daily.

What is the role of science in this debate? Science can help by providing the technical information necessary for good ethical decision making. For example, scientific studies can provide information about pain pathways and pain sensitivity in animals. However, they cannot tell us how much animal pain and suffering is acceptable in a particular circumstance, because that is an

ethical judgement. Similarly, preference and operant testing methods can tell us a great deal about what animals need or want, but cannot tell us whether or not we should provide more behavioral opportunities for them if the result is an increase in the cost of production or a greater environmental impact. Perhaps less obviously, science can also provide only partial answers to questions about animal well-being (Fraser, 1995; Sandøe and Simonsen,1992; Tannenbaum, 1991), because how much weighting we give to particular facets of an animal's welfare depends upon our own value judgements.

I will illustrate this point with two examples of poultry welfare problems. The first involves space recommendations for laying hens, and is discussed in more detail in Mench and Duncan (1998). In summary, there is now a large body of scientific evidence showing that hens kept at a housing density of less than about 460 cm2 per bird have higher corticosterone levels, decreased egg production, greater mortality, are more fearful, and have poorer feather cover (Craig and Adams, 1984; Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching, 1999). But this amount of space is not enough for the hen to perform most postural adjustments. Dawkins and Hardie (1989) videotaped hens and found that they required 500 cm2 just to stand normally and up to 1,800 cm2 to perform other movements like wing-flapping. Given the opportunity hens will space at greater distances from one another than even the most generous of these allowances would permit. Keeling and Duncan (1991) found that hens maintained distances up to 2 m away from flockmates. And if hens are given a great deal of room, as for example in a large house, they will move large distances, for example between nestboxes that are spaced 60m apart (Appleby et al., 1985).

How much space should a hen have, then? Those who value physiological and production measurements may decide that 450 cm2 is adequate, while those who value behavioral measures would consider that amount of space insufficient. How insufficient would depend on which behavioral measures they weighted most highly. Should the hen only be allowed to make postural adjustments (and if so only some postural adjustments, or all of them?), or should she be allowed to space at preferred distances from flockmates, or should she be allowed to engage in her full range of movement patterns? It was the inability to reach agreement on space recommendations for caged laying hens, because of just such disagreements, that led to the recent European decision to ban cages entirely.

The second example is beak-trimming, which is used to eliminate problems associated with feather pecking and cannibalism in laying flocks. Beak-trimming is known to cause both acute and chronic pain when it is performed after several weeks of age. A chicken's beak is highly ennervated, and beak-trimmed hens develop neuromas in the beak stump that are similar to those found in humans experiencing phantom limb syndrome (Gentle et al., 1990). They also show a persistent reluctance to perform beak-related activities like feeding and pecking after beak-trimming, which is reflected in weight loss (Duncan et al., 1989; Craig and Lee, 1990). But cannibalistic pecking is undoubtedly also painful for the recipient, since it causes severe and often fatal injury. Even simply having feathers pulled is painful (Gentle and Hunter, 1990), and hens in beak-trimmed flocks appear to experience less stress (Struwe et al., 1992). Feather pecking and

cannibalism can occur in any housing system, but generally are more common in extensive systems like deep litter houses or aviaries. In these systems mortality due to cannibalism can be as high as fifty percent, although its incidence varies enormously from flock to flock for reasons that are not yet clearly understood.

The scientific facts about beak-trimming are not in dispute. Yet in Britain it was decided to continue beak-trimming in extensive systems until an alternative method for controlling cannibalism could be found, while in Sweden beak-trimming was banned. In both countries more extensive production systems are considered better because of the benefits that accrue to the hens in terms of an increased opportunity to perform natural behaviors. There is also a willingness in both countries to take the risk that undesirable behaviors (and hence some harm to the hens housed in them) will be increased in such systems. However in Britain, unlike Sweden, the costs to the hen (and perhaps the resulting product costs) associated with *not* beak-trimming are considered to outweigh the costs associated with trimming. Sweden does not allow any "mutilation" of animals, and this suggests that one principle they particularly value that affects their decision not to beak-trim is that of autonomy, or animal integrity (that is, animals should not be changed in essential ways to "fit" them to a production system).

There are many other cases, of course, in which scientific evidence about animal welfare is still lacking. Obtaining this information is critical to good decision making, but there are now many examples of improvements in animal welfare that have come about as a result of scientific studies. Examples for poultry are the development of mechanical harvesters that are less stressful for the birds than human handling, improved transport methods that decrease heat stress and mortality, more humane slaughter methods like gas stunning, and improved cage designs that result in decreased injury rates (Lacy and Czarick, 1998; Mitchell and Kettlewell, 1998; Raj, 1998; Tauson, 1998).

However, for the reasons discussed above, science (or even perceived "facts") will not always be the final arbiter of decisions about the appropriate treatment of animals. And of course there are some facets of animal welfare that will prove particularly difficult to study scientifically. Many of the concerns about animal welfare relate to the feelings of animals, particularly feelings of fear, frustration, and suffering (Dawkins, 1980). Although animal welfare scientists are developing a variety of increasingly more sophisticated methods to assess these states empirically (Dawkins, 1998), their existence will never be definitively proved.

Eventually, we will need to decide whether or not to extend the "benefit of the doubt" when addressing particular welfare problems based on the accumulation of many pieces of evidence derived from studies of animal behavior, neurophysiology, and other aspects of animal biology. A recent report by the U.K. Parliamentary Agriculture Committee addressed this problem in the context of policy-making: "We consider that society has a duty to decide upon certain standards in respect of its treatment of animals. We maintain that this can be done without relying on philosophical arguments about animal rights or the nature of suffering. Although all due regard must be given to the scientific evidence about the various aspects of 'well-being', these standards

still have to be decided upon in the absence of 'proof' about whether an animal 'suffers' and what its 'natural' behavior might be (quoted in Harrison, 1987).

Those of us who work in animal agriculture, whether as scientists, veterinarians, educators, producers, or administrators, need to be sensitive to the sensibilities that inform public (consumer) views about animals and their welfare. One benchmark of these values is the increasing level of oversight of animal research that the public has required since the passage of the Animal Welfare Act in 1964. Although historically there has not been as much concern about farm animal welfare in the US, that situation appears to be changing. Voters in California last year resoundingly passed two animal welfare referenda that were opposed by the agricultural community. The first banned the sale of horses for slaughter for meat, and the second prohibited the use of certain types of traps and poisons for controlling pests or trapping for fur. This year there will probably be proposals on the ballot to stop the sale of frogs and turtles for food in (Asian-owned) live animal markets and to prevent egg producers from inducing a molt in their hens by withdrawing feed. What seems to be underlined in several of these propositions is an increasing reluctance to accept profit, or even cheap food prices, as a compelling rationale for ignoring certain interests of animals. The message for animal agriculture was stated succinctly by Thompson and colleagues (1992): "The need for balance between human and animal interests must now be accepted as the norm for animal agriculture."

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RAMIFICATIONS FOR THE INDUSTRY AND POULTRY VETERINARIANS

Morning Session
10:00 - 11:40

Speakers in this Session

Dr. Mark Pattison
Dr. Paul B. Siegel
Dr. William B. Chase
Dr. Richard D. Reynnells

CURRENT STATE OF POULTRY WELFARE IN THE EUROPEAN COMMUNITY

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ABSTRACT

The welfare of all animals kept on farms is now a regular topic of discussion by all parties involved in the food chain, from the farmer through the retailer to the final consumer. This represents a huge change in the way food production from animals is regarded. As little as ten years ago, only farmers themselves and personnel directly involved in animal production had any interest in such matters as stocking density, ventilation rates, litter quality and standards of water and feed supply. Now over this relatively short period of time, this information is being asked for by many retailers and increasingly by the general public themselves. This places a bigger responsibility on farmers and farming organisations to inform and educate their customers and the public about animal production and farming methods. The majority of farmers have always had a strong affinity with their animals and this new requirement to inform and educate is merely an extension of their day to day work, with which they are happy to be involved.

There are probably a number of factors that contribute to this climate of change and the need to know more about animal welfare. Food safety issues have become head line news since the BSE crisis started in 1987. This was followed by the discovery of *Salmonella enteritidis* in eggs in 1988 and the incidence of Listeria in cooked delicatessen products and soft cheeses. *E. coli* 0157 in ground beef keep food issues in the headlines, so inevitably more and more people wanted to know about all aspects of the food chain. Thus the welfare of animals and food safety became inextricably linked. There has also been more activity by welfare groups, some responsible and others not, and they have targeted specific activities such as animal transport and the shipping of live animals from the UK to other countries.

The UK Government set up the Farm Animal Welfare Council (F.A.W.C.) in 1979 and this body has had increasing responsibility in setting standards and advising Agriculture ministers on changes that are needed in animal welfare laws. UK ministers are now involved in lengthy discussions in formulating EU directives that concern the welfare of animals kept for food production in all EU countries. In response to all these changes, the major retailers in the UK (of which about six control 80% of all UK food distribution) are setting up codes of practice for farming with a requirement for both independent and self auditing to ensure that these standards are being incorporated into regular production practices. In addition there are some special codes (eg. Freedom Foods being developed) by certain organisations, which are trying to set special, high standards of welfare for which the consumer might be expected to pay a premium.

Animal welfare is perceived in very different ways in the various EU countries as might be expected in such a widely disparate group of religions and cultures, so this paper will concentrate on the UK situation and show how these may influence the progress of farm welfare in the European Union as a whole.

The specific aspects relating to welfare as it affects the poultry industry are discussed.

GENETICS AND BEHAVIOR IN POULTRY[1]

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SUMMARY

The last half of this century has seen dramatic changes in the breeding, production, and processing of poultry. Purebreds and dual-purpose stocks have been replaced by synthetics, selectively bred to excel in either egg or meat production under husbandry practices designed to maximize their genetic potential. Genetic changes in economic traits have also resulted in positive and negative changes in physiological, immunological, and behavioral traits. This paper discusses the genetic-behavior interface as a domestication process in poultry where historically the driving force has been to achieve goals set by humans. These goals may or may not consider behavioral modifications resulting from direct selection or indirectly as correlated responses.

INTRODUCTION

The interfacing of genetics and behavior in the production of poultry is important because recognition must be given not only to the mode of inheritance of behaviors, but also how behaviors influence performance and gene pools of subsequent generations. The behavior of an individual is dynamic and relates to a state of psychological and physiological harmony between it and its environment. Although the genetics of an individual remains constant (barring mutation) throughout life, genetics of populations change over time. Phenotypic expressions of behaviors, as well as morphological, immunological, and physiological traits, are dependent on genetic background, environment, and the interplay between heredity and environment. Prior experiences of the individual and the history of the population are also involved in phenotypic expressions at any point in time.

An individual's ability to adapt to its environment is a function of selection during the history of the species and/or population plus adjustments made throughout life. When consideration is given to types of behaviors and selection forces acting on them, it is instructive to remember that phenotypic expressions of some behaviors can be modified considerably by environmental factors while phenotypic expression of others may be essentially closed to environmental experiences. In this paper environment is inclusive of internal factors such as immunological responses and hormonal changes as well as external factors such as photoperiod and diet. The intent of this paper is to discuss the behavior-genetic interface in poultry which may influence well-being positively or negatively, rather than provide a comprehensive overview.

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[1]Portions of this paper relied heavily on papers of Siegel (1993, 1995).

[2]Appreciation is extended to S. I. Jackson for manuscript preparation.

SELECTION

Selection is a process which allows some individuals and precludes others from contributing genes to subsequent generations. With natural selection, changes in gene frequencies across generations are usually gradual, which allows time for adaptation. Exceptions include drastic environmental insults such as exposure to highly infectious diseases which result in high mortality (McNeil, 1976). In contrast to natural selection, artificial selection accelerates the rate of change not only for the selected trait(s) but also correlated traits resulting in a negative effect on adaptive mechanisms.

Artificial selection of poultry goes back several thousand years with goals changing with time. Although today's commercial chicken is far removed from the habitat of its jungle fowl ancestor, the dynamic has accelerated greatly during the last 50 years when general purpose purebreds were replaced by synthetic stocks bred specifically for production of egg and meat products. The development of such stocks via an intense selection and crossing of breeds and lines has been spectacular, as has the development of intensively mechanized production units. With the dawn of a new century, questions are being asked as to the well-being of highly specialized stocks husbanded in these production units.

DOMESTICATION

Darwin stated that domestication was a goal oriented in an economic sense and resulted in disuse of certain naturally adapted features. These comments by Darwin are consistent with the view that domestication is a continuing process whereby genetic variation for traits is modified via selection to attain certain goals. To review behaviors that initially favored the domestication of the fowl with behavioral issues of today is instructive. Before doing so, it should be pointed out that species-typical behaviors have persisted, in that behavioral modifications have been quantitative rather than qualitative. That is, rather than causing the elimination or introduction of behaviors, thresholds of response to stimuli were altered (Price, 1984).

Hale (1969) discussed behavioral characteristics amenable to domestication of species during the Neolithic period. These characteristics included a hierarchal group structure which facilitated intermingling of sexes and altering population size, promiscuous sexual behavior, precocial young with rapid parent-offspring attachment, nonspecific dietary habits, positive reactions to humans, and adaptability to a range of environments. Under intensive husbandry of poultry some of the behaviors which initially favored domestication are no longer relevant. Eggs are artificially incubated, young are reared as separate age classes away from their parents, specialized diets are fed, the persistency of egg production has been extended, photoperiod is controlled, and motor activity is limited. In my opinion, of the behaviors that favored domestication initially, adaptability to a range of environments and ability to react positively to humans are still essential with the latter perhaps a subset of the former. This comment does not infer that other behaviors are no longer of relevance. With changes in husbandry practices other behaviors have become relevant and how best to address them is neither clear nor without controversy. Some of these

behaviors may best be addressed through human intervention via husbandry procedures, while others may require a combination of husbandry and breeding programs. Discussions of genetic approaches have been provided by Mench (1992), Mills *et al.* (1997) and Muir and Craig (1998).

ISSUES

Examples of issues concerning behavior-related traits include food intake, mating efficiency, beak injuries and feather picking, responses to social stressors, and avoidance and escape reactions. Not only is there genetic variation for these traits, but they are amenable to change through artificial selection. References providing more detail are: food intake (Pym, 1985; Nir *et al.*, 1996; Siegel, 1998), mating efficiency (Siegel, 1965; Siegel and Dunnington, 1990), beak injuries and feather picking (Craig and Muir, 1993), responses to social stressors (Gross and Siegel, 1985; 1993), and avoidance and escape reactions (Craig *et al.*, 1983). Implementation of this knowledge into applied breeding programs is not easily accomplished because of the complexity of expression, genotype by environment interaction, and difficulty in measurement. Successful breeding requires that traits be recurrently identified and classified, and this is not always the case with behavioral traits associated with social conditions. For example, a stable peck-order reduces nonadaptive energy expenditures. To establish a stable peck-order requires individuals to exhibit aggressive and submissive behavior depending on the dyad.

Food intake behavior provides an example where food consumption should be optimized not minimized. Undereating can be addressed genetically because in addition to age, a minimum body weight and a balanced carcass composition are required for the onset of sexual maturity. Although individuals who do not achieve this balance, and hence would not produce offspring, can be brought into a reproductive state by force-feeding, this is not a realistic approach. In contrast, food intake can be controlled in animals predisposed to overeating. Food restriction programs have been criticized, however, the alternative of allowing meat stocks to feed *ad libitum* can be devastating for adult layers (O'Sullivan *et al.*, 1991) and in the event of a disease outbreak in growing chickens (Katanbaf *et al.*, 1988).

The human factor takes on another element in providing adequate, but not over stimulation both short- and long-term. Craig (1981) states,

> *"behaviors appropriate in the natural environment may need to be modified if the animal is to be most useful under domestic conditions. Some changes are brought about by genetic selection and others by careful manipulation of the environment. The relative importance of genetic and environmental influences in changing traits is not always clear. . ."*
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> *page 28*

Acceptance of this statement makes moot the issue of whether the environment should allow for expression of all 'natural' behaviors because humans have already 'ruled-out' need for expression

of some behaviors that initially allowed domestication of poultry. For others there is room for debate, especially in the case of 'abnormal' behaviors which result in mutilation that is self-directed or involves members of the flock.

FUTURE

The coming years will see a continuation of intense selection for economic performance of poultry. Although intensification of husbandry practices should level, production units will probably be more mechanized and larger. Human relationships will become increasingly important and behavioral responses will have to be addressed through genetics and nongenetic avenues to enhance the well-being of both individual birds and entire flocks.

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THE ROLE OF THE POULTRY VETERINARIAN IN WELFARE ISSUES

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A musical introduction from "How to Succeed in Business Without Really Trying, -- you have the clear, cool eyes of a seeker of wisdom and truth". This is the part, or role, we as a profession have to play in the animal welfare question.

The Veterinarian's Oath: Being admitted to the profession of veterinary medicine, I solemnly swear to use my *scientific knowledge and skills* for the benefit of society through the protection of animal health, and the *relief of animal suffering*, the conservation of livestock resources, the promotion of public health, and the advancement of medical knowledge. I will practice my profession conscientiously, with dignity, and in keeping with the principles of veterinary medical ethics. I accept as a lifelong obligation the continual improvement of my professional knowledge and competence. (The italics are for the speakers emphasis).

Rights are not the issue. Rights can only be held by a human and given or respected by humans. We have certain animal care obligations as veterinarians, but conferring rights to animals is not one of them.

All living things share some commonality. We are genetically identical to the chicken at 80% of our gene locations. We are 98% identical to the chimpanzee. What a difference a few genes can make. A boy, is a dog, is a rat, etc. is just not supportable by the scientific evidence.

The anthropomorphic view, while easy to see, is not accurate or in keeping with our oath. We must exclude ourselves from the philosophical debate with the "**Anthropomorph**". The literature from United Poultry Concerns will illustrate the view of some people in the visceral arguments that we must not enter. You can not reason with the unreasonable. We need to study and define what *animal suffering* really is from the scientific perspective. Are our practices causing animal suffering when viewed from scientific perspective? If yes, we must change them based on the scientific facts uncovered.

We can not justify our practices or actions based solely on the economic impact they will have. While it is true, that good practice usually results in good economics, we can not use that as the sole justification to continue their use. We have an obligation to provide proper care even if the economics do not support it.

Some questions to be answered by the veterinary community.

- Are birds in cages really suffering?
- Is the use of beak trimming justified?
- Does molting, or resting cause undue suffering?
- What are acceptable live haul, shackling and slaughter practices?
- Etc., Etc., Etc.

We have to look at things with the "cool clear eyes of a seeker of wisdom and truth". We must be a scientific voice of reason, not a profession just trying to justify our existence and practices based on the economics of the day. We have taken an oath, let us now live up to that obligation.

MAINTENANCE OF THE WELL-BEING OF POULTRY--- PROACTIVE TRAINING OR REGULATIONS?

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SITUATION

Assuming adequate breeder flock rations and management, the well-being of poultry starts at the hatchery and ends at slaughter. Between these points, formal and on-going training and evaluation programs are important to bird well-being and can contribute positively to profit potential for producers and integrators. This is true if the birds in question are broilers, layers or turkeys.

Non-existent, inconsistent or defective training and evaluation programs for a poultry operation can result in reduced well-being of the birds and reduced profit potential. For purposes of this paper, training will be defined to include evaluation programs. If grossly out of control situations exist, the result can be a wide range of negative responses, including the opportunity for production of under-cover videos that document abuse of the birds. Such a situation is stated as the stimulus for the current discussion.

In 1997, the Humane Society of the United States (HSUS) was asked by a broiler grower to assist in correcting what he perceived to be a very negative situation. Company and grower conflict apparently exacerbated the situation created by the catching crew. According to the account presented of the situation, the integrated company representatives ignored or discounted a grower's plea for proper treatment of the birds by the catching crew. The company was reported to have even told the grower to just keep quiet about it if he wanted more birds. This is the same as telling the person his job, and his farm, can be taken from him if he does not go along with whatever is happening, even if it is unethical or perhaps illegal. If true, company insensitivity would be an understatement. Also if true, it is possible that management training could have helped provide a better response to what has been presented as an honest concern, and to create a positive response to a delicate and potentially explosive situation. The undercover video, of which you will see portions, is the result of interactions between the grower and HSUS representatives. The video title is : "Chickens Under Contract: A Bad Deal for Chickens and Farmers". You may view the entire video later during the week, and you will be provided a copy upon request. Some people believe, due to apparent inconsistencies in the footage that the video was staged---or at least portions were less than an honest portrayal of reality. I have been assured the events occurred as depicted. However, neither absolute position is relevant to this discussion.

Germane to this discussion is that some level of mishandling (abuse) did, and possibly at times may, occur. As managers in a highly competitive industry, it would seem prudent to minimize

mishandling of birds and to view comments by growers as potentially valid, and then verify the degree to which statements are true. Company credibility is in part based on honesty, open communications, and consistency of policy. Credibility is damaged by ignoring honest concerns of growers and employees, the status of which can only be determined through an objective analysis. To the extent comments are accurate, corrective action must be taken where possible. However, from several other viewpoints it would appear appropriate to prevent negative situations from occurring. These negative situations that are related to improper management include: bird health and condition for slaughter; profit potential; conflict between growers and management; and, possible public relations problems. Training is a proactive and effective preventative for these negative situations, while accentuating positive aspects of the company.

TRAINING

To be effective, training must be important at the highest levels in management---leaders must lead. Training programs must be formal, on-going and the results used as a basis for policy and management decisions. Training programs would minimally include: comprehensive orientation; job specific training; supervision at all levels; component and overall evaluation summary; and re-training based on results of area-specific output/product evaluations. Obviously, training and evaluation can and should also be of the more instantaneous variety, whereby problems are corrected when they occur. Timely and constructive feedback to personnel is essential.

Evaluations of performance (e.g., quality of vaccinations or beak trimming) should be formal, with frequency related to the risk (e.g., current quality) and should occur at random or unpredictable times. Evaluations should also be informal, and may include a subjective analysis, or perception, by chick bus drivers and delivery personnel, growers, catching crew supervisors, hatchery personnel (e.g., chick transfer or vaccination crew), or more standardized criteria such as dehydration score by service representatives or others.

Collection of data with no follow through is probably worse than having no evaluation. False expectations are raised by inconsistent, inappropriate (e.g., biased) or the absence of follow through. Training program effectiveness may be evaluated by measuring and recording data related to specific criteria (e.g., the beak trimming score at the hatchery) or various field conditions. The training program (or lack thereof) must be modified to correct for any deficiencies that are found. Likewise, employees may require re-training or other forms of encouragement for sub-par performance or even transfer to another section, or dismissal. Bonuses, pay rate or other incentives may be tied to completion of training, and performance above a certain standard. This would apply to sub-contractor as well as company employees. It is important to remember that subcontractors and company employees represent the company, and their attitude should properly reflect company policy and vision on all issues. To do so they must be properly trained, supervised and retrained.

Some people believe an action or attitude becomes habit after about 25 times. The number is variable, depending on the situation---or source of the opinion about the required frequency. The

significant concept is that habits are learned behaviors. If there were equality between development and maintenance of "good" and "bad" habits, and retention of "good" habits, training and evaluation (Quality Control) could be a relatively minor part of a company's structure. But this is not likely to happen. Probably because it seems "good" habits require considerably more effort and attention to detail than "bad" habits, and the latter likewise appear very easy to create and maintain. Conversion of "bad" to "good" habits requires awareness, motivation or incentive, and supervision with appropriate reinforcement. Training and evaluation are the basis for this conversion process.

POTENTIAL FOR REGULATIONS

Whether stakeholders or shareholders, people often feel a compelling need to dictate the activities of others. The need to dictate the actions of others may come from inflated egos, from the need to save the world according to a certain vision by proselytizing a particular philosophy that is often based on a person's religion, from a genuine concern for animals, or from other motivators. Stakeholders can be defined as persons who are directly impacted by a company's or agency's activities, and often have a direct monetary interest in the outcome of decisions. Shareholders can be defined as persons who are only indirectly impacted by these activities or decisions, or are only interested philosophically in certain situations. Activist groups claim stakeholder status in agricultural policy and industry standards because they consume food or have a certain felt kinship with animals. Shareholder status may be a more appropriate descriptor for activists.

Public relations are now, or should be, an important part of management. Actual or perceived abuse or mishandling of animals is no longer tolerated by most of society. Certainly, and regardless of the label appropriated by groups, punishment of documented abuse is rightfully the purview of society, often in concert with activist or various local humane groups. However, even relatively minor negative situations may be used effectively against individual companies or an entire animal industry. The ability to avoid needless controversy (with the attendant costs to company reputation and burdens on personnel), without even considering animal well-being or the potential positive effect on profit, should be sufficient stimulus to develop effective and on-going training and evaluation programs. These programs must represent proactive and effective environmental, food safety and animal welfare policy by the company. The program's value must be maximized by communicating general results and commitment to quality to the public and decision makers.

The days when what you did on your own property and how you treated your animals, was your business are essentially over. They <u>are</u> over in England and some other countries where there apparently is even a prescribed frequency of visual observations of animals, or other minutia are dictated. Many other countries have codes of practice which dictate the range of acceptable management options for their farmers. The European Union has rather restrictive legislation, which there is little doubt will be promoted as part of various international marketing agreements.

Canada has a Recommended Code of Practice for the Care and Handling of Poultry from Hatchery to Processing Plant (Canada Code of Practice), Publication 1787/E. The regulations include the Handling of Neonate Chicks, including their removal from the hatching trays. Paraphrasing examples of their requirements, they discuss the procedure: ...not done by tipping the trays; move trays smooth and level; not thrown or dropped; and, prevent (chicks) from falling...onto the floor. For release of chicks: they are not to be placed or dropped from a distance likely to cause injury; and should be placed onto a surface with padding to cushion impact. For receiving neonate chicks on the premises (farm): boxes of live chicks must be handled...level....and never thrown; and not removed by dumping the box; but chicks can be removed by tilting the box slightly and pushing them out or by inclining the box slowly, then withdraw the box from under them in a swift smooth movement. If removing live chicks by hand, do not squeeze them, and not drop chicks more than 15 cm (6 inches) on a hard floor, or more than 30 cm (12 inches) on a soft floor. How do these standards compare with the chick delivery crew in the video that dropped the chicks from the box from nearly waist high, and to your facilities? What of the person who carries five or more chick boxes and drops them at the delivery point in the house (notice in the video how some chicks can get their neck caught between the boxes when they bounce)? Is this what we want to see on the evening news? Do poultry system personnel treat poultry like valuable animals that should not be unnecessarily harmed, or "widgets"? Is it necessary to have regulations, with the resulting potential for power hungry regulators who can inspect your facilities, make demands of management, and initiate punishment (e.g., fines) procedures, or are training programs a preferred option?

As a former farmer, I continue to detest regulations and someone telling me how to run my business, and can not understand the mind set of people that apparently prefer that situation. By not recognizing or appreciating the shift in society's increasing predisposition to control what should be the personal activities of others (e.g., tobacco, legal use of guns,...), and by not taking strong proactive steps such as training and evaluation programs that minimize real or perceived management errors, I believe we are shortening the time when more regulations will exist that dictate how food animals will be raised. Without even considering the well-being of animals or profit potential, or the potential use of training and evaluation programs as a marketing tool, the avoidance of regulations seems sufficient stimulus to implement an effective training and evaluation program at all production levels. By looking at the situation in other developed countries, it seems easy to predict the eventual outcome that could be avoided with a commitment to solid management and other training programs, with subsequent correction of deficiencies and creation of awareness by public decision makers of this commitment and progress.

SOCIETAL INFLUENCE

Maximum respect of society for our poultry system is earned through the use of good husbandry practices that are environmentally sound, that result in a product which is safe to eat, and where products are produced in systems where growers and employees were treated fairly. This is also the basis for discussing claims in the video, and ways to address the issues. I am not saying the video contents are accurate, or if any is inaccurate. I am saying we need to consider areas of

possible accuracy, and take preventative and corrective action. Prevention of problems can occur with the implementation of on-going, objective, practical, and comprehensive training programs.

Training programs should not be used to point the finger of blame at units other than your own, but to objectively evaluate and improve total programs. Note that no management unit is independent of all others. Each unit is dependent on the quality of inputs, of which they may improve or reduce the quality as their output or product. To the extent a quality factor is out of the control of a particular unit, responsibility must also be shifted. If within control of a unit, the evaluation and training program should account for the problem and corrective action to be taken. Passing the blame to others is not conducive to teamwork or to solving problems (e.g., nutrition is not always the problem!). None of this will happen with a complacent attitude by top management and supervisors because the training program will not be started. Leadership is essential to the success of training and evaluation programs that are in turn essential to bird well-being and the long term sustainability of the company. These programs are also essential to the capacity of a company to deal effectively with public relations challenges that may or may not be accurate. Understanding and support by society is critical when confronted by zoning, legislative and purchasing decisions. Quality training, supervision, and a commitment by everyone to produce a high quality product while protecting the environment and the well-being of the birds are critical to maintenance of societal approval and the capacity to forestall regulatory controls.

ISSUES AWARENESS

There is also a need to train ourselves and employees to understand the issues surrounding animal well-being, which is used as a facade by some animal rights activists to promote their agenda. This is also true for the concepts of environmental protection, food safety and preservation of the "small" farmer. It can be argued that animal welfare or well-being or protection is not the basis of animal rights (statements to that effect have been made by animal rights groups). Animal rights is a philosophical concept that can also be argued is highly influenced by Eastern religions such as Hinduism, Jainism, etc. These labels have been confused, blended and misused to the point of acceptance of circular reasoning: animal rights = animal protection = animal welfare = animal well-being = caring = reasonable requests = animal rights. Thus, if the need for increased regulations are presented with sufficient documentation, there is increasing likelihood of their acceptance as a reasonable request.

Perhaps if there was greater understanding of why animal activists of all types believe as they do, and the level of commitment they feel, we would be better prepared to deal with potentially explosive situations. Perhaps animal activists are correct in some instances. If so, why not change? If they are not, we must be in a position to define the need for certain management practices in relationship to society's demand for cheap, plentiful, and safe food. Ideally, animal activists would also not be so self-centered to believe that only their opinion is valid, and would also change if they recognized the industry's challenges and efforts. We can not educate ourselves in these issues if all we do is continue with our preconceived ideas and talk only among ourselves. We must first recognize that the animal rights issues are very complex. Activist

organizations may have personnel representing a wide spectrum of philosophies within the group, and the complete range certainly exists external to individual organizations.

Animal welfare issues have a long history of being controversial, often with polarization of opinions. Due to the absence of information provided by a third party widely perceived to be unbiased, a series of 14 summary articles on animal welfare issues were developed by USDA/CSREES/PAS personnel. The primary audiences are county Extension agents and Land Grant University faculty who interact with a variety of clientele that may have questions or concerns about these issues. Extensive references are provided in nearly all topic areas. Topics covered are: A Critical Analysis; Animal Exhibits, Shows and Fairs; Beef; Dairy; Equine Production and Performance; Fur Farming; Handling of Crippled and Non-ambulatory Livestock; Hunting and Conservation Issues/Gamebird Shooting Preserves; Poultry; Rabbits; Sheep and Goats; Swine; and, Veal. Authors are responsible for the final product.

The Compendium is available at the USDA National Agricultural Library (NAL), with serial publication in the Animal Welfare Information Center Newsletter. The Compendium has been provided to the Cooperative Extension Service Director of each Land Grant University (1862, 1890, 1994), who will determine distribution in their area. Commodity groups, animal activist groups, and others also have been provided a copy. Using the document's articles and references in conjunction with a bookstore, or the local library and the inter-library loan service, may effectively educate poultry company personnel.

Acknowledgment is necessary for the interactive role played by the author on the planning committee of the "Future Trends in Animal Agriculture" series of conferences, and the visit to USDA by several animal activists. It is important to understand that without this conference participation, networking, and the capacity for activists to know an unbiased series would be produced so they could support the project, and visit USDA to express that support, it would have been impossible to obtain permission to develop the Compendium. Henry Spira (ARI; deceased), Melanie Adcock and John Hoyt (HSUS) played significant roles in obtaining permission for this project. Persons on both sides of the issues participated in a double review of the papers. The National Agricultural Library is another essential player is this project, because they are the repository for the document, and have published the articles as a series in their newsletter.

SUMMARY

By becoming aware of the issues that can result in more regulations, and their individual and collective implications for the poultry system, objective analysis of the situation is possible. If proactive and effective training and evaluation programs are put into place, in conjunction with a strong "good neighbor" policy, and along with open communications with the media and others, the industry should be able to avoid or minimize the extent of regulations. Bird management ties in with grower relations, environmental protection, food safety and any other issues society deems important. Analysis without action is of little value, except to place blame for failure. If the

preferred approach to errors in the management of birds and personnel/grower management is stonewalling, seeing all comments that define problems as coming from the enemy (such as the claims in the video), and all challenges as conspiracies, there is little hope for success.

Avoidance of regulations is an important goal of training, evaluation, and public relations programs. These programs can also build a strong public perception of the poultry system. To achieve these goals, the industry must make a collective commitment to high quality bird management---and most if not all companies do this---in combination with strong environmental protection programs, positive grower relations, and food safety, followed by equally strong educational programs for the public, the media, agency personnel, and legislators. A proposed plan is outlined in the Report of the Education, Training and Communications Workgroup of the "Poultry Dialogue" (Environmental Framework and Implementation Strategy for Poultry Operations) document available from the National Chicken Council (Telephone: 202.296.2622).

A positive approach to this situation creates a system that is beneficial to all components. As Carl Hoyt, former Michigan State University Extension Specialist and former Executive Secretary of the Michigan Allied Poultry, Inc., observed over 50 years ago: a good contract is fair to all parties. The corollary may be made for comprehensive management and other training programs: good training programs benefit all parties in the poultry system, and the birds.

AN INDUSTRY SEGMENT PERSPECTIVE

Afternoon Session
1:20 - 3:00

Speakers in the Session

Dr. Henry L. Classen
Dr. John T. Brake
Dr. Sally L. Noll
Mr. Donald D. Bell

BROILER PRODUCTION WELFARE ISSUES

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INTRODUCTION

Domestication of animals for human use has brought with it an obligation to manage them in a manner that is consistent with good husbandry and in a way that provides appropriate animal welfare. As animal industries have intensified, this obligation has increased in importance because animals raised under these conditions have little opportunity to modify their environment and as a consequence must rely on the humans that manage their facilities. The increase in the size of production units and the number of birds to be handled has also increased the difficulty of providing for the individual animal's welfare needs. Providing an appropriate level of animal care has also become a much larger public debate in recent years. In some countries, consumer pressure and legislation have dramatically changed production techniques. Evaluating the appropriateness of production systems is difficult even within the scientific community let alone in society as a whole where consumers are now a long way from the food production industry and no longer can identify with agriculture as a life style. The objective of this paper is to examine the broiler production life cycle and identify areas where animal welfare may be an issue and discuss potential methods to overcome these problems. The topics discussed may not be equally relevant to all geographical areas of production as might be expected because of differences in climate and production systems.

DEFINING ANIMAL WELFARE

The topic of this presentation could be examined in many different ways. Often five freedoms are used to examine the animal welfare standards of production systems. They are as follows:

1. Freedom from hunger and thirst
2. Freedom from thermal and physical discomfort
3. Freedom from pain, injury and disease
4. Freedom from fear and distress
5. Freedom to exercise most normal patterns of behavior

Although I will address these freedoms indirectly, I have chosen to follow the broiler production cycle and identify management and other aspects of modern broiler production that compromise these freedoms.

BROILER GROWTH RATE

The broiler industry, in continual pursuit of improved efficiency, has demanded rapid growth rate. Primary breeding companies have responded to industry pressure and growth rate has increased in an almost linear fashion since the broiler industry started. The prediction from these companies is that growth rate will increase in a similar manner for at least the short to medium term (5 to 10 years). Despite the obvious advantages to industry profitability, it can be argued that increased growth has placed more emphasis on the demand tissues of growth than those systems or organs that supply the substrates for rapid growth or are essential to support the increase in body mass. Modern broilers are not as adaptable to their environments as their predecessors were. In addition rapid growth has produced problems not seen in slower growing birds. Skeletal and cardiovascular disease are examples of growth related problems. Although it can not be said that rapid growth automatically will result in these problems, there is no doubt that there is a relationship. Also of no doubt, is that some of these problems (skeletal disorders, ascites) are animal welfare concerns. In recent years, primary breeders have focused much more attention on these issues but one must wonder if genetic selection for increased growth rate is nearing a maximum.

Growth rate can influence metabolic disease during the entire production period, but research has shown that the early brooding period is particularly important. Reduced growth rate from 3-14 days of age affects bird health during that period but also results in improvements later when growth rate is as fast or faster than birds that have not experienced slower early growth. These results indicate that early brooding represents an important developmental period in poultry meat stocks. Recently, strategies have been investigated to alter the growth curve of meat stocks so that early growth rate is reduced but final production traits are relatively unaffected. Methods have primarily focused on genetic selection, quantitative and qualitative feed restriction, feed form, and environmental management. Although there has been relatively little research on combining techniques, it is likely that their actions are additive in terms of bird health and performance. The focus of altering early growth has primarily been on bird health but benefits in improved feed efficiency and carcass quality have also been reported. See Table 1 for a list of potential methods of growth pattern manipulation.

Table 1. Relative efficacy of growth modification techniques on broiler productivity and health

Method	Weight gain	Feed:gain	Abdominal fat	Bird health
Feed restriction	- to =	= to +	= to +	+++
Nutritional modification	- to =	- to =	- to =	+
Feed form	-	-	= to +	+
Lighting programs	=	= to +	- to =	++++

- (negative), = (equal), or + (positive) effects on broiler characteristics

When deciding whether to manipulate the growth curve of modern broiler strains, one should consider a number of factors including the age and weight at marketing, market destination, ease of application (management), ability of birds to compensate for growth rate reduction, and the degree of health problems in the flock.

CHICK SERVICING AND DELIVERY

The extent to which chicks are handled after hatching varies considerably. After removal from hatching trays, chicks face what must be a confusing world of rapid movement, exciting falls, invasive procedures and handling. Chicks might be sexed, beak trimmed and vaccinated (injection, spray) before being placed in chick boxes for delivery to the farm. Because of the large number of chicks hatched at one time, more automated systems with minimal human contact are now being used. These systems reduce repetitive work by humans.

Are there welfare problems associated with this system? There is virtually no published work on the subject but one can speculate. The author's assessment of the probability of potential problems is shown in Table 2.

Table 2. Probability of animal welfare concerns from hatching to delivery to the broiler farm

Procedure	Probability	Comments
Handling	None to low	None if managed correctly
Sexing	None to low	Feather sexing is not a concern
Beak trimming	Low to moderate	Use only as required
Vaccination - injection	None to low	A concern for a small number of birds
Vaccination - spray	Very low	Mostly an animal welfare benefit
Chick storage	None to low	Relatively easy to regulate
Chick delivery	Low to moderate	Can be affected by quality of delivery trucks

Clearly if done roughly, handling can become an animal welfare concern. At first glance, automated systems might appear to not be animal welfare friendly. However, if running properly, they remove the human element where extensive repetitive work can lead to boredom, indifference and fatigue that in turn may lead to more of an animal welfare concern. Sexing is not a concern. Beak trimming is used in some situations where light intensity control is not effective in controlling feather picking and cannibalism. In these situations, quality control is required to ensure proper trimming technique. Vaccination benefits bird welfare unless improperly applied. Again quality control procedures eliminate vaccination as an animal welfare concern. Chick

delivery must take advantage of the ability of modern technology to provide an environment conducive to chick well being. At the farm, chick placement is probably not an issue.

BROILER HOUSING ENVIRONMENT

As indicated above, intensive production increases the reliance of the broiler on farm managers to ensure an adequate environment. Table 3 outlines some environmental factors that can affect broiler welfare.

Table 3. Probability of animal welfare concerns due to environmental factors during broiler grow out

Procedure	Probability	Comments
Temperature	Moderate	High and low temperatures
Relative humidity	None	Indirect effects on animal environment
Ammonia	Moderate to high	Irritant, 25 ppm maximum
Dust	Low to moderate	Disease vector
Litter quality	Moderate to high	Lesions in tissues exposed to wet litter
Light	Low to moderate	Dark exposure benefits bird health
Space requirements	Low to moderate	Floor, water and feeder space

The modern broiler chicken has a reduced ability to adapt to temperatures outside the zone of thermoneutrality. Low temperatures increase broiler metabolism and consequently lead to an increase in ascites, which is both an economic and animal welfare concern. High temperatures can lead to high levels of mortality due to heat prostration. Whether temperature should be considered an animal welfare concern is dependent on the probability of having temperatures reach levels that cause either low or high temperature effects. Barn structural and equipment needs should reflect the local environment. Although, they need not be planned to account for the absolute extremes in temperature, they should aim to control temperature within safe limits for the majority of the year. Low temperature should be preventable by ensuring that heating systems and barn structures can withstand cold outside temperatures. In addition, temperature uniformity in the barn may be affected by air distribution pattern within the barn. Tunnel ventilation and evaporative cooling are effective methods of reducing the effects of high environmental temperature.

In itself, relative humidity effects on animal welfare are small or practically non-significant. However, the equilibrium that develops between relative humidity and litter has an important impact on airborne ammonia and dust. These pollutants impact tissues that are in continuous contact with air such as the respiratory tract and integument. The impact of an air pollutant on

broiler production is a reflection of its effective exposure dose. This equals the level of the pollutant times the length of exposure time. Ammonia is the most important gaseous pollutant in broiler barns. It is the product of bacterial breakdown of nitrogenous wastes found in manure and conditions that favor microorganism growth in litter generally increase ammonia production. The most important factors affecting ammonia production are environmental temperature, litter moisture and pH. Ammonia acts primarily as an irritant and has a negative effect on tissues that it comes in contact with. The tolerance level of broiler chickens for ammonia is 25 ppm. Ammonia is a significant animal welfare concern but can be controlled via methods such as ventilation, waterer type and management, and litter additives. Atmospheric dust can result from excessively dry conditions. Dust acts as a disease vector as well as causing direct damage to the respiratory tract. As such, dust can affect bird well being. Dust control is primarily a function of ventilation rate although misting systems have also been proposed as a control method.

Litter quality plays an important role in determining the quality and welfare of broiler chickens. This reflects the intimate contact between litter and broiler chickens, and therefore the potential for irritation and damage to a bird's feet, legs and breast. It is also related to atmospheric pollutants derived from litter (see above). The same management programs that affect ammonia and dust production are used to produce good litter quality.

The use of continuous light in broiler housing increases flock mortality and decreases bird well being. Lighting programs which give one or more dark period(s) per day are particularly important during early life (7 to 14 d) as they decrease skeletal disorders, sudden death syndrome and ascites. It is the author's opinion that darkness exposure is essential to provide for the welfare of modern broiler chickens.

The exact amount of floor space required by broiler chickens is still a matter of debate and the recommended level varies considerably from location to location. In the United Kingdom, the recommendation is approximately 34 kilograms of biomass per square meter of floor space. Regardless of accuracy, this value does not tell the entire story. It does not state the amount of feeder or waterer space, or ventilation capacity required to maintain productivity and broiler welfare at that density of housing. It can be stated that below certain space standards, productivity (growth rate, feed efficiency, etc.) decreases while mortality increases. I have chosen to define floor space requirements in two ways. The biological optimum is the minimum space required to maximize the productivity of the bird. The economic optimum is the amount of space that provides the greatest economic return per unit of floor space. The latter space requirement is generally lower than the biological optimum because of the reduced overhead costs per bird. However, from an animal welfare standpoint, it is difficult to justify a space allotment less than the biological optimum.

NUTRITION

In general, broiler nutrition is of high quality to ensure high productivity. However, the recent reduction or elimination of essential vitamins and minerals during part or all of the finisher phase may be an animal welfare concern.

DISEASE PREVENTION

Infectious disease represents an important risk in the broiler industry and the consequences of disease are an animal welfare concern. The broiler industry must take reasonable precautions to eliminate or control infectious disease.

PRE-SLAUGHTER MANAGEMENT

The last day of a broiler's life represents an important time from both economical and animal welfare standpoints. Mortality, trimming and other losses at this time are very costly and can be associated with mishandling, poor environmental control on transport vehicles and/or rough handling at the processing plant prior to slaughter (Table 4).

Table 4. Potential animal welfare concerns associated with pre-slaughter management

Procedure	Probability	Comments
Catching/crating	Moderate	Bruising, DOAs, trim
Transportation	Moderate	High and low temperature, moisture, DOAs
Trailer storage	Moderate	High and low temperature, moisture, DOAs
Shackling	Low to moderate	Bruising, trim
Killing technique	Low	Relationship to shackling

The majority of broilers are still caught and crated by hand with most companies now using systems where the drawer or crate units are taken into the barn to the crating location. These systems are a major improvement over systems that used hand catching and where birds were carried to transport trailers outside of the barn. Despite these improvements, the catching and crating process is still one of the most undesirable jobs in the poultry industry. Some of the characteristics associated with this process are: large numbers of broilers to be caught in a relatively short catching time, repetitive, boring work, and frequently a poor barn environment. Catchers with very good intentions may become bored, indifferent or fatigued and as a result handle broilers in a way that compromises their welfare. Automated catching systems are now on the market and offer considerable potential to improve the catching process and the welfare of broiler chickens.

Research in the United Kingdom has demonstrated that the welfare of broilers can also be negatively affected during transportation. Temperature and relative humidity are two important factors that can affect death loss (DOAs). Use of power ventilation and/or better trailer design can overcome these problems and would appear to hold promise for broiler transportation. Broilers are frequently kept in crates on trailers at the processing plant for extended periods of time. Again the need for environmental control is emphasized to reduce welfare issues.

Shackling broilers has many of the work characteristics that were mentioned above for the catching process. Although birds will die relatively quickly after this point as a result of electrocution, mishandling can cause bruising, condemnations and/or down grading. As a result it can also be a welfare issue. Use of gas stunning prior to shackling would eliminate the animal welfare implications of this process.

CONCLUSIONS

In conclusion, the welfare of broiler chickens can be defined in many ways but perhaps the most relevant is in terms of poultry husbandry. What I have attempted to do is describe welfare issues that may arise as a result of poor husbandry. For most issues discussed in this paper, there is technology available now, or there will be in the near future, that can reduce the probability of broiler welfare problems. However, the application of technology is dependent on the economics of broiler production and in many situations economic decisions do not coincide with improved welfare. Therefore changes of this type may not occur without industry (self-regulation) or governmental regulation. Another factor which likely affects broiler welfare is the fact that many undesirable jobs which impact on animal welfare utilize staff which are paid low wages. This in turn impacts the quality and dedication of the staff. Finally, aspects of the broiler industry can fail and result in unacceptable animal welfare. Establishing the probability of failure would help identify the key issues that need to be addressed. We must address both real and perceived animal welfare issues in a positive fashion to ensure the long-term strength of the broiler industry.

CURRENT ISSUES IN BROILER BREEDER MANAGEMENT

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ABSTRACT

Broiler breeder management poses unique challenges due to their propensity towards hyperphagia and obesity that negatively impacts reproductive performance. Restricted feeding and watering regimes that do induce hunger, but do not constitute starvation, have been developed for the growing period that ideally allow all birds to eat and drink simultaneously. These nutrient restriction regimes have been shown to be necessary for reasonable reproductive performance and welfare. Adequate feeder space appears to be provided by ~17 pullets per pan-type feeder or 4 inches of trough space per pullet. About 60 to 80 pullets per bell-type drinker or 7 to 8 pullets per nipple also appear to be practical. Further, well-managed feed and water restriction regimes allow greater bird density due to maintenance of acceptable litter conditions. Adequate floor space per pullet ranges from 1.25 ft^2 to 1.4 ft^2 per pullet.

Restricted feeding is also practiced during the breeding period in the form of sex-separate feeding for males and females. This is generally accomplished by the use of specialized grills on the female feeders that force males to eat from a separate non-grilled feeder system. The grill opening has had to be gradually enlarged to 1 13/16 inches wide x 2 ¼ inches high to provide less hindrance to the female. Consequently, the practice of comb removal, ("dubbing"), of males has been reduced as this makes the head of the male much larger than that of the female and more easily excluded from the female feeder.

The minimum adequate feeder space during the breeding period for maximum performance appears to be from 4.5 inches to 6.0 inches per bird with a trough-type feeder. Water space requirements appear to be similar to those of the growing period. On typical 2/3 slat – 1/3 litter flooring systems a density of 1.8 ft^2 per bird is adequate.

Many of the current commercial problems of aggression, poor livability, and poor fertility appear to be related to excessively close adherence to body weight guidelines without sufficient attention to the manner in which the restricted feed amounts are administered.

Broiler breeder management involves a number of mechanical mechanisms needed to avoid the obesity inherent to these birds. A number of these issues have been reviewed previously (Brake, 1998) and the most salient issues will be reviewed briefly herein.

Restricted feeding of broiler breeders has been shown to be clearly beneficial (Lee *et al.*, 1971) as it controls body weight gain and prevents reproductive dysfunction associated with obesity. The restriction regimens presently required to adequately control body weight do induce hunger

(Savory *et al.*, 1993) and rapid feed consumption (Kostal *et al.*, 1992) but they do not constitute starvation as there is a weekly increase in body weight (Mauldin, 1992). Due to the severity of restriction, the feed allocation is often fed on an alternate day basis that allows the feed amount to be doubled on the "feed day" with no feed being given on the "skip day." Better distribution of feed to all birds is thus accomplished. Daily feeding has been advanced as a better alternative but little practical success has been realized and there is no reduction in plasma corticosterone levels (an indicator of stress) compared to alternate day feeding (Bennett and Leeson, 1989). A probable reason for the lack of success with daily feeding is the fact that it is ~10% more efficient for achieving body weight gain. Thus, birds fed on a daily basis can achieve suggested minimum body weight goals on less nutrition. As will be discussed later, this could create relative nutrient deficiencies that negatively impact bird health and performance.

With limited feed amounts and feed consumption time, priority has often been placed on providing enough feeder space for all birds to eat at once. The presumption has been that limited feeder space would negatively impact uniformity of body weight and subsequent reproductive performance, as larger birds would have an advantage over smaller birds. However, the optimum amount of feeder space per bird is difficult to determine. Recent research in our laboratory revealed no relative change in uniformity of body weight when feeder space was reduced from 3.07 inches (7.8 cm) to 1.54 inches (3.9 cm) per bird between 10 and 13 weeks of age. The latter allocation of feeder space was obviously limiting, in terms of allowing all birds to consume feed simultaneously, but all birds appeared to be able to obtain their relative allocation of feed and maintain their relative body weight position within the larger group. It is also reasonable to conclude that excess feeder space would be detrimental as there would be insufficient feed to distribute evenly. A more limited amount of space obviously contributes to better feed distribution at a depth of feed adequate for easy consumption.

The type of feeder system, trough or pan, also has an impact. In recent years there has been a trend toward the use of pan-type feeders for rearing breeders. Correctly positioned, pan feeders can provide more feeder space per house than trough feeders and thus allow greater bird density in each house. Under practical circumstances, good performance can be realized with ~17 pullets per 14 inch (35.6 cm) diameter pan during the rearing period or about 4 inches (10.2 cm) of trough per pullet. In the latter case, each side of the trough is available.

The trend towards pan-type feeders in the rearing house does not extend to the breeder house where trough-type chain feeders still prevail. Much of the reason that the trough feeder remains popular for the breeder house is that they are better suited for the use of "male exclusion" or "female only" grills placed on these feeders to allow females to eat while the larger headed males are excluded. In this scenario, the females are fed on the slats of a typical 2/3 slat - 1/3 litter broiler breeder house while the males are fed from an elevated pan-type feeder placed in the litter area. As the trough feeders are placed on the slats and make a different sound when operating there is the necessity of "training" the hens to the new feeder immediately following the transfer from the growing to breeding houses. This is often accomplished by the use of nets to keep the females on the slats and males on the litter for three days after housing at approximately 20 to 22 weeks of age.

The amount of floor space required for broiler breeders during the rearing and breeding periods is often a function of the adequacy of litter management. Without good ventilation to dry the feces deposited in the litter and good control of water intake nearly unlimited floor space will be required to maintain acceptable litter conditions. With good management, pullets may be reared on as little as 1.25 ft^2 per pullet (8.61 birds/m^2) with good results. An allocation of 1.4 ft^2 per pullet (7.69 birds/m^2) would be considered generous. Partial slats serve as a repository for feces during the breeding period and provide a margin of safety for litter management and ventilation. In the typical 2/3 slat – 1/3 litter breeding house, a bird density of 1.8 ft^2 per bird (6 birds/m^2) can produce acceptable results. All-litter (non-slat) facilities require an increase in floor space to 2.4 ft^2 per bird (4.5 birds/m^2). In the latter case, improved performance is often reported. This may be due to the fact that in a typical 2/3 slat – 1/3 litter house the trough feeder space available per hen is only about 4 (10.2 cm) to 4.25 (10.8 cm) inches per bird. With the same feeders and less birds in an all-litter house the feeder space increases to about 6 inches (15.2 cm) per bird. This suggests the minimum feeder space for adult broiler breeders to be between 4.5 (11.4 cm) and 6 inches (15.2 cm) per bird with a trough-style feeder.

Even when the feed allocation increases during the breeder period and birds are fed on a daily basis, the total feed consumption time increases to only about 4 hours per day as compared to as little as 1.5 hours per feed day during the growing period. When the birds are not consuming feed they can be observed to "play" in the waterers. This can easily result in a very wet house with associated disease problems. Thus, water availability is generally limited to a little more than the period of time that feed is available and slightly less total time on "skip" days. Strict water control is absolutely required to maintain a sanitary and healthy environment for broiler breeders. As many birds will be drinking simultaneously, there is a need for adequate water space. Practically, 60 to 80 pullets per bell drinker or 7 to 8 pullets per nipple may be used during rearing and breeding periods.

The particular male exclusion grill to be used on the female feeder must be selected carefully. Improperly sized grill openings will not only exclude the larger headed male as intended but also older (end-of-lay) females. Swollen heads of females have been reported as a result (Hocking, 1990a). This can negatively impact egg production. Exclusion grills were initially based on the principle that the width of the head of the male was greater than that of the female. As the eyes are situated on the sides of the avian head it was reasoned that the males would avoid the feeder. In fact, males often learn to defeat this device and some females were found to have a greater head width than the male. This has led to implementation of horizontal as well as vertical bars on the grills to take advantage of the obviously taller male head. To exaggerate this difference, many males are either left undubbed or partially dubbed. No dubbing at all can cause problems as the rear of the large comb can easily become entangled in the feeder grills. A grill opening that is 1 13/16 inches (4.6 cm) wide x 2 ¼ inches (5.72 cm) high appears to be satisfactory under commercial conditions.

There has also been interest in plastic "Noz-Bonz" (Nye, 1994) that are inserted through the nares near the time of sexual maturity. This device exaggerates the width of the male head. However, a number of males (~10%) can still learn to defeat the combination of this device and exclusion

grills. The combination of Noz-Bonz with partial dubbing can be successful but also reqres nipple waterers or large turkey-sized bell drinkers for the males as such males cannot drink from normal chicken-sized bell drinkers. However, many broiler breeders are being managed successfully without the use of Noz-Bonz.

To prevent females from eating male feed, the male feeders are typically elevated such that only the taller males can reach the feed. However, females can easily jump and eat from the male feeder during the later stages of the laying cycle (Brake *et al.*, 1993). A female exclusion grill that only allows the longer-necked male to reach his feed has been designed (Brake *et al.*, 1993).

The major impetus for sex-separate feeding during the breeding period has been the observation that poor fertility has been associated with overweight males (McDaniel and Wilson, 1986; Duncan *et al.*, 1990; Fontana *et al.*, 1990; Mauldin, 1992) and separate feeding was believed to be necessary to control male body weight. However, males fed near *ad libitum* are known to exhibit excellent spermatozoal production (Parker and Arscott, 1964; Sexton *et al.*, 1989). It is likely that overly severe feed restriction has actually caused fertility problems due to reduced mating activity as a result of caloric deficiencies. This may help explain the observations of Hocking (1990b) and Brake *et al.*, (1993) that sex-separate feeding does not always result in consistently improved fertility.

A thorough examination of all available data pertaining to the feeding of broiler breeder males and resulting fertility was performed in our laboratory with the subsequent development of a mathematical model (Peak, 1996). The model revealed that males, relative to their genetic potential, are often underfed in an attempt to control body weight to achieve primary breeder recommended standards. These standards appear to be unrealistic at certain ages. Our data suggest a minimum required cumulative nutrient intake from day-old to photostimulation of ~1600 g crude protein and ~32,000 kcal metabolizable energy per male.

It is also important how this feed is allocated on a weekly basis. Feeding programs that increase the weekly feed increment in proportion to body weight (concave-shaped) appear to enhance reproductive development based on field observations and research data with females (Walsh, 1996) when compared to linear or convex feeding approaches. Further, male livability also appears to be improved with a concave feeding program approach. In a similar manner, field observations reveal a measurable improvement in egg production of ALV-J positive broiler breeder females when fed with a concave rather than convex feeding program from 15 to 25 weeks of age. Such concave programs also improve the persistency of egg production (Walsh, 1996).

The concept of a minimum cumulative nutrient consumption, irrespective of body weight, required for optimum post-photostimulation female reproduction was first reported by Walsh and Brake (1997). These authors demonstrated that a minimum crude protein intake of 1180 g was required at photostimulation. Further, Peak and Brake (1994) reported the minimum intake of metabolizable energy to be ~ 23,000 kcal. This is in contrast to the ~ 28,000 kcal required to rear a female to the same body weight 15 years earlier (J. Brake, unpublished data). This dramatic

reduction is obviously the result of improved feed conversion. On the typical relatively high energy diets used in the USA, it is quite possible to achieve the recommended body weight standard without adequate intake of crude protein which will contribute to reduced fertility.

There has been much said about "male aggression" where males kill females, especially during the onset of egg production. This does not occur in the same strain of birds universally, which suggests some management factor. Our data suggest that it is relatively immature or nutritionally deficient males that exhibit aggression (Brake *et al.*, 1998). Further, a female component is suggested by our observation that females grown to the same body weight on various crude protein levels and mated to the same group of males exhibit mortality only when the protein intake is deficient. Solving the problem of "male aggression" through better nutrition and feeding programs would also reduce the need to remove more than one digit per foot on males (Ouart *et al.*, 1986). There is now evidence that properly reared males can be used successfully without any digit removal.

Skeletal problems and foot health remain issues in broiler breeder management. Wilson (1994) reported that the lower back abnormality scoliosis (Duff and Hocking, 1986), typically referred to as "roach back," could be reduced by an adequate feed allocation. In our hands, adequate protein intake is also effective. Pododermitis may be related to slat type and structure. Square or rectangular slats or perches, in comparison to those that are round, reduce pododermitis (Duncan *et al.*, 1992; Tauson *et al.*, 1992). Further, wooden slats and perches are better than plastic slats or perches because the latter are often too smooth to adequately clean the feet of birds (Haar and Meijerhof, 1994). There is growing interest in plastic coated wire slats as well. Uncoated wire slats have been used successfully for many years.

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TURKEY PRODUCTION: MAXIMIZING COMFORT AND PRODUCTION

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Maximizing comfort and production in turkey farming is sometimes perceived as being at odds. While production performance is not always considered the best indicator of animal well being it is of major importance to the producer. With recent interest in the attainment of the full growth potential of the market turkey, this has meant greater review and assessment of production practices in poult handling, brooding and growing management. Potentially there are many different stresses that could impact the utilization of feed nutrients and appetite, thus negatively affecting traditional measurements of performance. The stressors can take the form of various environmental conditions and management practices.

Researchers at the University of Minnesota (M. El Halawani, P. Waibel, S. Noll, D. Halvorson and D. Shaw, Departments of Animal Science and Veterinary PathoBiology) have investigated the effects of nutrition and management conditions of male turkeys. Different environment conditions were established with lighting programs, rearing temperatures, type of toenail trimming, and litter condition. Feeding programs based on Nicholas and British United Turkey recommendations were fed in mash and pelleted forms. Details regarding each study can be obtained in past reports (El Halawani and co-workers, 1990, 1991 and 1992; Waibel et al., 1991).

Temperatures during growing can have a great impact from the standpoint of feed intake and air quality. Emmans (1989) estimated the "comfort temperature" of male turkeys at different ages. Based on potential growth and the heat produced by that growth, temperatures in the range of 50 to 54 F would be needed at ages 10 to 18 weeks. Without the ability to remove that heat, feed intakes and growth rates decline. Comparison of rearing toms in warm (70 F), cool (56 F), and cold (45 F) temperature conditions indicated that weights were greatest in the cool environment while feed efficiency was negatively affected in the two temperature extremes. Waibel and MacLeod (1995) indicated that energy retained as protein in growing turkeys tended to decrease in turkeys exposed to warm and cycling temperatures, especially those that had access to food when the temperature cycled upward to 84 F. Turkeys reared at 61 F continued to have positive nitrogen balance.

Warmer environmental conditions induce panting in turkeys in an effort to dissipate heat. Under environmental conditions where air quality is poor, an increase in carcass condemnation can be observed without the presence of other respiratory disease conditions. Cooler rearing temperatures increase humidity and thus helps to suppress dust.

However, in cold climate situations a drop in outside temperature can result in a rapid increase in ammonia levels as ventilation becomes restricted in an effort to maintain barn temperature. The ammonia production is the result of breakdown of nitrogenous compounds in the litter. It was

hypothesized that periodic removal of manure would decrease ammonia production as might occur in the collection of manure with a slotted flooring system. A partial slotted floor system was developed and tested for the rearing of turkeys (Noll et al., 1997). Performance of turkeys was improved with the slotted flooring and ammonia levels were reduced. However, the incidence of breast blisters was increased in the slotted flooring system and would prohibit the use of this system commercially. Ferket (1998) found that a partially ventilated floor system improved performance of turkeys and reduced ammonia emissions.

Litter additives have also been used to decrease ammonia levels (Hulet, 1997). A test with addition of magnesium chloride to the litter found that a one-time addition decreased both dust and ammonia levels in comparison to a non-treated litter control.

Lighting programs have been shown to affect growth rates, feed conversion, carcass traits, and mortality rates (Cunningham, 1993). Lighting programs can be defined by the duration of light and dark periods as well as light intensity and lamp type. A continuous lighting program is where the barn is lighted for a continuous period of time varying anywhere from 10 or 14 hours per day up to 23 hours per day. Nixey (1991) indicated that for the BUT turkey excessively long day-lengths could lead to leg problems. An alternate lighting program is the intermittent light (IL) program where lights cycle on and off several times during a 24 hour period. However there is not agreement as to the most optimal program (Cunningham, 1993). Studies at the University of Minnesota has shown an intermittent light program in mechanically ventilated buildings gives the best body weight gain and improves feed conversion (Noll et al., 1991). The question arises of getting the same response from IL in open sided buildings with curtains or panels, which allow light leakage to occur.

The effect of light interference during the dark cycle of the IL program was studied in three trials. Toms grew to similar market weights under some form of intermittent light. All forms of intermittent light tended to improve growth and feed conversion in comparison to the continuous lighting program. Apparently complete light control is not needed to utilize an intermittent light program. The effect of intermittent light is much greater as the birds get older which means the program can also be initiated after the birds are moved from the brood barn.

Trimming of the toenails or claws is practiced to reduce carcass damage due to skin tears (McEwen and Barbut, 1992; Moran, 1979; Moran, 1985; Owings et al., 1972). Studies have indicated that toenail trimming can be detrimental to starting poult livability and can negatively affect body weight (Supeene, 1978; Newberry, 1992). Our studies gave very similar results. In the first study, toenail clipping tended to increase 10-day mortality (2 vs 4%) through increased losses due to starve-outs and leg problems. Toenail trimming also increased the incidence of leg problems from 12% in the non-trimmed birds to 18% in the toenail trimmed. Body weight and feed conversion were not affected. Toenail clipping did improve carcass grade with those turkeys having a greater percentage Grade A carcasses (71%) compared to non-clipped toms (60%). Downgrading occurred in the non-clipped group due to scratches on the surface of the skin and tears/cuts which penetrated the skin and muscle.

In a third trial, a new commercial nail trim process was tried by administering microwaves to the nail. Body weight gain tended to improve when the microwave technique was used. Leg problems were reduced at 12 weeks but not 18 weeks of age with the microwave technique compared to the conventional process.

Pelleting of the feed improves weight gains and feed efficiency. Some strains of turkeys appear to do better on a pelleted diet. In one trial, BUT toms responded greatly to pelleting of the BUT diet, increasing body weights by 4.85% and improving feed efficiency by 5.38%. Nicholas toms responded less so to pelleting of the Nicholas diet, increasing body weight by 1.30% and feed efficiency by 3.02%. Early feed intake was reduced in the BUT poults. The difference in feed intake and growth rate among the strains would indicate that nutritional adjustments are necessary and that the feeding system should be reviewed to give adequate nutrient intake. The low feed intake of the BUT turkey poult would mean that care needs to be taken to encourage feed consumption. Nixey (1989) has indicated the influence of feed form and providing additional feeder space when starting BUT poults.

Feeding of pelleted diets has been proposed to impact litter moisture. It was found that litter moisture was greater for the BUT pellet diet series probably due to the higher protein content in those diets. Incidence of leg problems was less in those turkeys fed the mash diet in comparison the pelleted diets.

Some of the above environmental conditions were found to impact turkey growth, feed intake, and carcass quality to a greater extent, especially that of air quality and environmental temperature. Further improvements in performance could be made with lighting program and feed programs.

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ECONOMIC IMPLICATIONS OF CONTROVERSIAL LAYER MANAGEMENT PROGRAMS

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ABSTRACT

Economics plays an essential role in the choice of management programs in the poultry industry as well as in most businesses. Economics drives the selection of systems, products, and procedures among a long list of alternative options. Costs, values, profit margins, competition, overhead, performance, efficiencies, etc. are all economic subjects and are of vital importance in their effect on the management of today's modern agricultural enterprises.

Management programs are chosen only following careful consideration of their relative worth compared to alternative programs. Managers are charged with choosing sound programs, enacting them in detail, monitoring their applications and continuing their evaluation when new alternatives come along or when price/cost conditions change.

This paper emphasizes some of the economic implications of program selection in the controversial areas of caging systems for laying hens, beak trimming and induced molting. Analysis of relative biological performance is stressed with cost/price calculations emphasized to discover the economic impact on the operation. The impact of imposed regulations on systems is discussed.

INTRODUCTION

Commercial management practices for laying chickens are chosen on the basis of their ability to perform a basic task with a minimum of detrimental effects to the flock or to the environment in a cost-effective manner (ref #29). For example, feed must be delivered to a flock frequently and in an adequate quantity and quality to satisfy each chicken's basic needs for nutrients. The delivery system must be well designed, competitive in price, free of defects, and low in maintenance costs if it is to be selected. This same principle is followed for the selection of every management system in use today.

Obviously, there are many alternative systems which can do a comparable job and individual farmers have different needs which may require different systems. This is why we see a variety of systems and practices. Owners use different strains of chickens, different feeding programs, different poultry houses, and a wide range of other management techniques. Farmers strongly defend their choices and justify them on the basis of their own experience. They get good responses from their flocks, the help finds the systems easy to work with, and ownership believes they are cost-effective and yield the highest returns on their investments.

Some of the practices in use today by the commercial table-egg industry are being criticized by observers of the industry. These practices are perceived as being harmful to the flocks or ones

which fail to address the specific behavioral needs of the chickens. They include:

1. the use of animals in any way;
2. the caging of chickens;
3. the use of beak trimming;
4. the use of induced molting,
5. transportation and handling systems;
6. and others.

This list includes items which may require absolutely no change from current procedures, others which may need some modification to eliminate problem areas, and some which might justify major changes or even elimination from the list of choices. The industry, as well as individual producers, must take a hard look at their systems to determine whether on not adjustments should be made in areas of flock welfare and health without adversely affecting the economics of the operation.

This paper will address three areas from the list above which have drawn the most criticism in recent years - caging, beak trimming and induced molting.

CAGES FOR TABLE EGG LAYING FLOCKS

The commercial application of cages for egg production began in the 1930's, became widespread in the 1940's and 1950's and is currently thought to represent 70-80% of the World's production. Today, we would estimate that 98% or more of the commercial production of the United States is in cage systems.

During this 50 or more years of use, cages and their associated equipment have been improved and modified, cage density has increased (more hens per cage and/or less space per hen), strains of birds have been developed to perform more efficiently in current management systems, and other programs (feeding, health, beak trimming, lighting, etc), have been adjusted to conform to the needs of birds in cage situations.

Concern has been expressed that chickens should not be caged. The argument is that birds are not able to express their "natural behavioral needs". They can't "nest" their eggs, dust their plumage, choose their feed, run around, or attempt to fly. In becoming domesticated and managed, the caretaker has either eliminated some of these practices or changed the way these needs are addressed. Originally, these concerns were not expressed as layers were housed in single-bird cages. Cages were applauded for removing chickens from their own feces and for eliminating the centuries-old problems of internal worms and parasites. Eggs were cleaner, working conditions for the farm laborers were better and general management was easier. But, most importantly, egg farmers made money with these new systems. Under these conditions, crowding was not a concern and single birds did not develop anti-social tendencies, therefore beak trimming was not necessary when pen-mates were not present.

The original single-bird cages provided each layer with 150 to 200 $in.^2$ of floor space and 5 to 10 inches of feeder space. As time passed, egg producers found they could add additional birds to their cages with little if any performance losses. As space allowances were reduced, performance was lost to the extent that further crowding could no longer be justified..

University of California research with the cage density issue dates back to 1961 when we studied the effects of adding a third bird to a standard 2-bird cage. The reduction from 108 to 72 $in.^2$ did not affect hen-day egg production, but mortality due to prolapse-pick out increased from 1.4% to 7.4%.

A second study in 1963 added a fourth bird to this same cage size and compared it to a 3-bird cage (72 vs 54 in^2). In this case, hen-day egg production was reduced from 64.0% to 61.7% and prolapse-pick out mortality was doubled from 3.4% to 7.8%. Obviously, this density was approaching an un-economic level.

During the 1960's and 1970's cage densities gradually increased until today, when 48 and 54 $in.^2$ per bird have become the standard space allowances for laying hens in the US (white-egg strains). This compares to the 70 $in.^2$ (450 cm^2) standard in Europe and other countries for predominately brown-egg birds. Current discussions in Europe center around the questions of increasing allowances to 124 $in.^2$ (800 cm^2) or complete elimination of the cage altogether. Interestingly, government officials recognize the need to "block the import of eggs from countries with weaker animal welfare standards otherwise Economic Union egg farmers would be put out of business by cheap eggs from elsewhere in the world".

Also during this same time period, numerous research studies have demonstrated time and again that additional birds decrease hen-housed egg production and increase mortality. Our analysis of 45 different experiments conducted across the US and Europe show 14 fewer eggs and 3.9% higher mortality rates for each addition of one bird per cage.

Even though performance is adversely affected by increasing cage densities, egg producers can often justify the more crowded cage densities at different cost/egg price relationships. With many producers, current levels of egg prices and feed prices will not justify the lower space allowances. On the other hand, some producers can justify crowding under almost any cost/price relationship because of their ability to manage such situations.

In the last 20 years, the laying cage has gone through many modifications. Whereas the original cages commonly held 1-4 birds, today's cages are designed for 6-10. As a result of University of California research relative to cage design and other factors, more emphasis is now placed on feeder space allowances with most systems allowing 3-4 in. per bird (ref #3). Cages have become more "square", thus allowing each chicken more feeder space. Multiple drinkers are recommended to avoid problems when an individual drinker becomes inoperative. Manure systems are designed to store wastes in a different level of the building or to be removed on a daily basis.

Today, we use larger cages than in the 1950-1960 period and the most popular cages are for 6 birds with space allowances of about 54 in.^{2} per bird. In 1994 a large scale experiment was set-up on a commercial California farm to measure the performance and economic differences in placing 5, 6, and 7 birds per 16" wide by 20" deep cage (ref #10). This experiment was conducted over a 38 week experiment (to 58 weeks of age) with 53 thousand DeKalb Delta White Leghorn hens. Data was based upon 24 rows of 2200 birds each. Results are listed in Table 1.

Table 1. Performance results - Univ. of California Cage Density Experiment - 1994

Trait	5/cage *	6/cage *	7/cage *
Hen-housed eggs	198.0	194.3	185.2
Av. egg weight (g/egg)	59.8	60.1	60.3
Total weight of egg mass/hen housed (kg)	11.84	11.65	11.16
Mortality (%)	6.5	8.4	9.4
Daily feed intake (g)	105.6	101.4	99.4
Profit index/hen-housed ($)	3.97	4.08	3.79
Profit/cage (high costs) ($/cage) **	4.68	6.18	5.32
Profit/cage (low costs) ($/cage) ***	11.98	14.66	15.06

*Cage size = 16 in. (40.6 cm) wide x 20 in (50.8 cm) deep.
** High costs = $2.50 per pullet, $7.50/100 pounds of feed, $.50/dozen eggs.
*** Low costs = $2.00 per pullet, $6.00/100 pounds of feed, $.50/dozen eggs.

Table 1 illustrates that the highest returns per bird were obtained in the 6-bird cage. This was due primarily to a reduction in feed usage. The highest return on investment was also obtained in the 6-bird cage during low profit years, but with high profit years, the higher density (7 birds per cage) maximizes returns on investment. A fixed high density choice over time, might result in company failure during periods of extended low profit margins.

The choice of cages (design, size, shapes, etc.) and their management systems have many economic implications as discussed above, however, the proposed legislated elimination of cages in Europe will have even greater economic effects for egg producers throughout the region, to their suppliers and to the consuming public. The current proposal to eliminate cages within the next ten years is a major step backwards in the way flocks are managed. Flock health will be severely affected with major food safety implications. The current non-washing policy for eggs will likely have to be changed to adjust to the dirtier eggs produced by litter or free-range systems. Higher flock mortality rates are likely to occur thereby offsetting some of the claimed welfare advantages for non-cage systems. One European legislator was quoted as saying

"Changing from battery to free-range eggs would cost the average consumer less than £2 a year". This would represent $850 million per year in the US - not a small amount of money!

Cages have many advantages that should not be discarded in exchange for the one presumed disadvantage of " the flocks' inability to express their natural behavior". The scientific community must communicate the net losses and gains which accrue when husbandry practices are abruptly and totally changed. Total effects are much broader and more complex than a mere £2 ($3.20) increase in costs to the consumer.

Caging is a pro-welfare system of housing laying hens. It results in **improved livability, healthier flocks and higher profitability.**

BEAK TRIMMING

Beak trimming is a management practice used to reduce cannibalism, feather pecking, and other anti-social behavior in chicken flocks. Its benefits are widely acknowledged in the commercial chicken industry. Benefits include:

1. Reduced mortality from pecking.
2. Reduced injuries and sub-normal performance.
3. A general calming of the flock.
4. Reduced feed wastage and feed usage.

Today's methods date back to the early 1940's when the University of California developed a technique using a sharp edged device capable of being heated to cauterize the beak (ref. #11). Dozens of experiments and field trials subsequently refined the practice as we know it today. Beak trimming involves a complex set of decisions which describe in detail the process:

1. Age of birds to be trimmed.
2. Timing relative to other management practices.
3. Amount of beak to remove.
4. Shape of the cut.
5. Blade type and sharpness.
6. Blade temperature.
7. Time of cauterization.

Failure to monitor and control any of these can give less than desirable results. Even though there are methods to reduce the severity of this problem, beak trimming still appears to be justified when one considers the advantages and disadvantages of this issue.

Lower light intensities in controlled environment houses will tend to reduce the problem of cannibalism and thus may eliminate the need to beak trim for cannibalism control per se. Some strains of birds have very low levels of anti-social behavior, but advantages can still be

demonstrated for beak trimming. Reduced cage densities will lessen mortality problems associated with crowding, but economics may still dictate the use of beak trimming to control costs.

Commercial-scale experiments comparing beak trimming vs non-trimmed controls are difficult to conduct as farmers are reluctant to risk the increase in mortality they expect by not trimming a large number of their birds. In addition, proper experimental design requires replication of treatments and large numbers of hens in each replicate are required to make meaningful assessments of mortality effects.

In 1994 an experiment was set up on a large commercial farm in California to measure the differences in performance between beak trimmed and non-trimmed birds. (Table 2) (ref. #14).

Table 2. Performance results - University of California Beak Trimming Study - 1993/94[1] (40 weeks of results with projection of economic results to 78 wk.).

Trait	Beak trimmed	Not trimmed	Statistical Significance[2]
Hen-housed eggs	191.5	195.7	***
Av. egg weight (g/egg)	58.9	59.7	***
Total weight of egg mass/hen housed (kg)	11.27	11.68	***
Mortality (%)	3.39	4.73	***
Daily feed intake (g)	96.0	101.3	***
Profit index/hen-housed ($)	3.99	4.00	not significant
Profit (projected to 78 weeks of age) ($)	+ $.24/hen housed [3]		

[1] 71 thousand Hy-Line W-36 White Leghorn hens (18-58 weeks of age) Non-trimmed versus 7-week trimmed.

[2] * ($P < 0.05$), ** ($P < 0.01$), *** ($P < 0.001$)

[3] Projected profits to 78 wk of age is based upon 1.25 ¢/wk profits during the 51-58 wk period.

The California experiment included 71 thousand birds placed in 32 - 2200 bird rows. Cages were 16" wide by 20" deep and 6 birds were placed in each cage. The experiment was conducted for 40 weeks beginning at 18 wk. of age and ending at 58 wk. Because the birds were to be molted at 60 wk., the last 20 wk. of results were projected from performance levels during weeks 51-58. Economic differences at that time were due mainly to feed consumption savings for the beak trimmed birds.

Significantly higher egg production and egg weight were observed in the non-trimmed birds, but they also experienced more mortality and consumed more feed. Mortality in this experiment was exceedingly low in both treatments due to the strain of birds used. The 1.34% difference in mortality in favor of the beak trimmed birds was highly significant ($P< 0.001$) and would have probably been missed in traditional smaller experiments. The 5.3 gram per day reduction in feed consumption in the beak trimmed birds was associated with lower body weights (105 grams/bird) and a slightly lower production of egg mass. Eighty percent of the differences in feed consumption were associated with these two factors. Waste did not appear to be a major contributor to the differences noted.

A similar experiment in 1997 by Anderson and Davis at North Carolina State University compared two beak trimming methods with a non-trimmed control. This experiment included 3160 pullets for 64 weeks of production. This experiment was unique in that "fearfulness" and feathering were evaluated. Results are listed in table 3.(ref #16)

Table 3. Performance results - North Carolina State University Beak Trimming Study - 1996/97

Trait	Non - trimmed	6 day precision method	11 wk severe method
Hen-housed eggs	316	335*	333*
Hen-day egg production (%)	79.8	81.2*	80.9
Av. egg weight (g/egg)	61.1	61.5	60.5
Fearfulness score[1]	2.95	2.50*	2.20*
Feather score[2]	3.00	4.80*	5.75*
Mortality (%)	26.3	18.7*	17.1*
Daily feed intake (g)	122	114*	107*
Egg income minus feed cost ($/hen-housed)	8.38	9.87*	10.23*

[1,2] The higher the number the greater fearfulness and greater feather cover.
* Significantly different than the non-trimmed birds.

Unlike the California study, higher hen-housed egg production was observed. This was due principally to high mortality and major differences in mortality between beak trimmed and non-trimmed treatments. Similar trends to the California research for feed consumption were seen with a marked reduction exhibited by the trimmed groups.

The fearfulness score was significantly higher for the non-trimmed treatment indicating a further advantage for beak trimming. And finally, the feather coating was markedly superior in beak-trimmed birds. This may be a significant contributor to the lower feed consumption observed.

Individual beak trimming methods also show dramatic differences in flock performance as seen in Table 3. Even though the 6 day precision and 11 wk severe method birds laid practically the same number of eggs, feed consumption, feather score and economics favored the 11 wk severe beak trimming method.

Performance differences between beak trimming methods have always been seen in University of California experiments dating back to 1972 (Table 4). Interestingly, similar to the North Carolina research, the more severe (apparent) methods commonly outperform the less severe methods. No economic analysis was made in this experiment.

Table 4. Beak trimming methods and performance - University of California - 1972[1]

Trait	7 day precision	12 wk moderate[2]	12 wk severe[3]
Hen-day egg production (%)	69.7	69.4	72.8
Hen-housed eggs	216	213	231
Mortality (%)	13.9	16.5	12.0
Egg weight (g/egg)	55.5	56.0	55.9
Daily feed intake (g)	116	113	114

[1] 22 to 70 wk. of age.
[2] Top beak to 1/4 inch of nostril, bottom beak 1/3 trimmed.
[3] Top beak to 1/4 inch of nostril, bottom beak 2/3 trimmed.

A significantly higher egg production rate was observed in the severely trimmed groups. The 18 eggs improvement was unexpected because of the apparent severity of the method.

A similar experiment was conducted in 1981 to verify the moderate/severe beak trimming comparison. A third method was added - a one cut technique for both beaks. All trimming was done at 12 weeks. This experiment was also designed to determine if results were different with different colony sizes. Results are shown in table 5.

Table 5. Performance results - University of California Beak Trimming Study - 1981[1].

Trait	Moderate 3/cage	Moderate 4/cage	Severe 3/cage	Severe 4/cage	One cut 3/cage	One cut 4/cage
Hen-day egg production (%)	77.1	71.5	78.0	76.0	74.8	74.9
Hen-housed eggs	246	217	243	244	232	216
Daily feed intake (g)	104	105	103	103	103	105
Mortality (%)	7.3	18.0	11.5	8.6	15.6	24.2
Egg income minus feed cost ($/hen-housed)	3.24	2.35	3.18	3.11	2.84	2.63

[1] 20 to 68 wk of age.

Results of this experiment verify the results of the previous experiment by demonstrating the superiority of the severe beak trimming method but primarily in the more crowded environment. Feed consumption was similar for all methods, but mortality differences were large. In summary, the more severe method was the method of choice, especially in the more crowded condition. Mortality was reduced and profitability was higher.

Beak trimming is a practice that no one likes, but it does prevent higher levels of cannibalism and appears to be of major economic importance to the industry. The selection of the best method is also an important decision for poultry flock managers. But, of equal importance, the monitoring of the practice is essential to be sure that techniques are applied evenly across the entire flock.

Beak trimming is a pro-welfare management technique and is done to **reduce mortality** and to **improve profits in egg production.**

INDUCED MOLTING

Induced molting (forced molting) is a procedure used to rejuvenate laying flocks for a second cycle of egg production. Molting, as applied by the farmer, has been used off and on in the commercial egg industry for almost one hundred years. Early mention was made in Professor Rice's book in 1905. It was revived in the 1930's in the Pacific Northwest region and has been practiced at a high rate there ever since. Its second re-birth occurred in the late 1950's in Southern California and has been incorporated in a high percentage of replacement programs throughout the country.

Induced molting usually involves removal of feed for periods of 5 to 14 days followed by a low nutrient ration for the remaining days in a 28 day molt program. Molting, in nature or induced by the farmer, have the same effect - rejuvenation of the flock with resulting higher egg production, renewal of feathering, and improvements in egg quality.

Molting programs involve an estimated 75-80% of the commercial flocks in the US. At any point in time, 25-30% of the nation's layers are either in a molt or have been molted earlier - this represents some 70 million layers out of a total of 250 million.. Molting is considered a part of the normal replacement policy on the majority of farms in the US today. Options for the farmer include 1, 2, or 3 cycle programs with disposal ages ranging from 75 to 140 weeks of age.

It's estimated that replacement programs that include molting result in at least 15% higher profit margins for the egg producer compared to all-pullet programs (1999). Model building computer software is available to construct typical 1,2, and 3 cycle flocks. Such models are based upon individual owner experiences or can be developed from breeder standards. Although developed to determine optimum replacement policies, they can also be used to determine "what if" situations for different cost/price situations or for conditions unique to a particular region of the world.

An example of performance, cost, and income for a typical molt and non-molt program is shown in table 6.

Table 6. Comparison of a single cycle program with a two cycle program - 1999

Trait	Single cycle (80 wk sale)	Two cycle (110 wk sale)[1]
Av. hens (%)	95.6	93.4
Av. wkly mortality (%)	.150	.154
Hen-day egg production (%)	77.9	72.9
Eggs per hen housed	312.9	428.7*
Large & above eggs (%)	76.9	81.1
Total egg mass (lbs/hen housed)	41.7	58.1*
Undergrade eggs (%)	5.5	5.6
Av. egg value (¢/dozen)	52.7	53.4
Daily feed consumption (g)	101.6	98.9
Feed per dozen (lbs)	3.45	3.60
Feed cost (¢/dozen)	25.0	26.0
Pullet cost (¢/dozen)	9.6	7.0
Feed + pullet (¢/dozen)	34.6	33.0

[1] Molted at 65 weeks of age

* Longer period of time.

In this example, after exclusion of other costs, the annual income per hen housed from the molt program is estimated to be $1.32 compared to $1.15 for the one cycle non-molted program - an increase of 15% in profits. With lower egg prices or higher feed prices, even greater differences would exist. Molting is more justified under low margin conditions (low egg prices or high feed prices).

As one can see, molting is an important tool for optimizing profits in the egg industry. Much of the controversy about molting is not about the practice itself, but is directed at the **methods** used to molt a flock. Practically all methods require some degree of feed or nutrient restriction and this is not acceptable to many. There are methods which limit specific nutrients (calcium, sodium and protein) which are used in countries that do not allow feed withdrawal. Most of the research with these methods has not proven them to be as satisfactory compared to traditional feed removal methods (ref. #19).

The elimination of induced molting in the egg industry would have far-reaching effects on egg producers, their suppliers and the general public. US egg industry's cost and egg price conditions result in very narrow profit margins and the choice of replacement programs has a major impact on a farm's profitability.

Technology is usually adopted slowly and the total effect is spread over the entire industry over a several year period. This prevents massive over-night changes in egg supplies and resulting disruption of the egg market. From time to time, different developments have come along that have dramatically changed the performance characteristics of the nation's flock and major changes in the industry's profitability have occurred. Examples of this include: major disease epidemics, large changes in feed prices, and significant changes in the performance characteristics of different strains of chickens. Eliminating a primary management technique (molting) arbitrarily, is an example of an extremely disruptive problem. It would result in:

1. The nation's laying flock would increase in size by about 3% as a result of higher house utilization.
2. All-pullet flocks would lay at a 4% higher rate than two-cycle flocks do today. (Both of these would have a major negative effect on egg prices)
3. Higher costs of production
4. Approximately 47% more:
    a. Additional chicks to hatch
    b. More breeding farms and breeding flocks
    c. More hatcheries
    d. More male chicks to be destroyed
    e.. More spent hens to market
5. Higher percentages and numbers of medium and small eggs

Induced molting is a vital component of the replacement programs used throughout the industry. Without molting, flocks would be kept beyond the optimum age for high egg quality, costs to the industry would be prohibitive and the age at disposal for flocks would be shortened from the current 105 to 110 weeks to 75 to 80 weeks.

Induced molting is a pro-welfare management technique and is done to **lengthen the productive life of flocks and to improve profits in egg production.**

SUMMARY

The well-being of commercial laying flocks is the result of the systems chosen and the quality of management to make them work as intended. Oftentimes, simple changes can be made to improve these systems which result in both improvements in the well-being of the flock and the profitability of an operation. Careful monitoring of caging, beak trimming and induced molting procedures will minimize the risk of hurting our flocks and their performance. High reproductive performance is an excellent indicator of overall good management.

The choices the farmer makes are driven mostly by economics and economics can not be arbitrarily dismissed from its important position. Most welfare issues are incremental ones:

* more birds per cage reduces performance
* more days off feed increases mortality
* the more beak removed, the greater the damage
* and so on

Regulations either eliminate practices altogether (no cages) or place numeric restrictions (450 cm^2 per hen) on a practice. Such regulations are usually enacted to address the exceptional problems but are imposed upon all. If the regulatory route is chosen, it must be based upon scientific fact and not the expedient approach of totally disallowing a practice for political reasons.

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Note: Extensive reference lists are also included in the following papers by the author: Cage design and density - item #10, beak trimming - item #14, molting - item #19.

AN INDUSTRY ASSOCIATION PERSPECTIVE

Afternoon Session
3:20 - 4:40

Speakers in the Session

Dr. Albert E. Pope
Mr. Steven L. Kopperud
Dr. Charles W. Beard

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