

Food Animal Agriculture in 2020

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Future Trends in Animal Agriculture

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Preface

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The year 2020 seems like the distant future, so much so that our ability to impact the realities of that time appears insignificant. To put this in perspective, looking at the same time frame in history, what changes have we seen in agriculture since 1994? Had we held a similar symposium then, with 2007 substituted for 2020 as the target year, would we have guessed the changes we have seen? Some, perhaps, but certainly not most of them. What questions can we ask today to help us better prepare for the future?

In 1994, organic agriculture and the related natural food alternatives were rapidly increasing in value and acceptability but were still seen by many if not most people as the folly of hippies. In late August of this year, Whole Foods purchased their primary rival, Wild Oats Markets, for \$565 M. This merger was claimed by the FTC to give an unfair competitive advantage in the natural foods market niche but was over-ruled in the courts. Whole Foods contended the organic and natural niche market is moving mainstream (i.e., the intensive agriculture model) and their competitors now include the major grocery chains. Whole Foods had sales of \$5.6 B, while Wild Oats had sales of \$1.2 B for a total of \$6.8 B (from an article by Janie Gabbett, 8/29/07, for meatingplace.com). Michael Pollan, in *The Omnivore's Dilemma* (Penguin Press, NY, 2006) provides an interesting discussion regarding the organic and natural niche market industries and corporate structure.

As a general observation, animal activists continually condemn animal agriculture for having a corporate, industrial or factory structure, while initiating and perpetuating social injustices through their vertical and horizontal integration achieved by consolidation and contracts. Criticism also focuses on food animal companies playing to the cheap food demands of consumers, as fueled by corporate grocery chain buyers and food distributors. During organic agriculture's transition from the dalliances of hippies to big business enterprises, have we heard any of the animal activist groups staging a major protest? A meager protest? Silence? This question is not to disparage organic/natural food production, particularly artisanal production, community supported agriculture, or similar programs. They are viable and appropriate use of our resources. The purpose is to ask the question of consistency regarding our concerns and treatment of food animal production sectors, and suggest we take a more holistic approach to identifying and promoting solutions to our concerns about the structure of agriculture and animal welfare.

Wal-Mart and other major retail food distribution chains now have organic and natural or perhaps minor locally grown food sections. I understand that organic/natural/free range/etc. producers are subjected to the same sharp knife as used for many years on conventional food producers to whittle away their return on investment, and take all or most of the cost of retailer's cheap food promotions out of the farmer's profit/equity. This situation has greatly contributed to our current consolidated agricultural system. Where is the protest? Where are the stated or implied small independent farmer/rancher alternatives as promoted for conventional food animal production? Did they die with consolidation? Do most consumers know or care?

If the next 13 years bring similar changes to the structure of agriculture, if globalization brings our food to us as primarily imports, and if our national food security is essentially nil (because of less institutional memory as to how to actually raise our own food, a lack of equipment, and fewer people who want to do this work) will there be protests? Will the next 13 years bring the abolition of food animal production in the USA as is desired, but not stated forcefully and publically, by some activist groups? If abolition succeeds, or if regulations for food animal production become a reality and are oppressive, what will be the result? Will biosecurity regulations, based on fears of bioterrorism, force out of business the few remaining small abattoirs and private food animal processing facilities? If these small abattoirs are eliminated, can the small food animal component of organic and natural food animal production continue? If food animal production moves off-shore, will auditing programs ensure future foreign producers meet the animal welfare and food safety standards demanded of today's American farmers?

Will the food distribution system continue to consolidate, and if so what will be the impact on farmers? Society? Farmers already have little leverage (a perishable product), and some are more than willing to undercut the price of other farmers to sell their product. A strengthened buyer segment, that comes with consolidation, will only solidify the Aprice taker® status of farmers. Will we import more of our food because it is cheaper, as food distributors, retail buyers, and society demand? Will the result of these least cost business decisions be increased short term profits of mega-food distributor corporations that result in bigger CEO bonuses, rather than a strengthened agriculture? Will genetic decisions for most food animals be made by an ever reducing number of persons, and what will be the consequences? Are heritage breeds, reservoirs of genetic diversity, doomed?

Will the international body, the OIE (World Organization for Animal Health), be the arbiter of all things related to global food animal production, processing and transportation? Will it happen in 2030? Who will be the animal welfare czar? Who will decide how animals are raised? Consumers? Or, an elite class that claims to represent animals and consumers, and that may or may not have ulterior motives?

Little has changed regarding the conflicts noted in the 2006 Future Trends in Animal Agriculture symposium (Addressing International Trade Complexities of Animal Welfare; see the proceedings). Who are the primary beneficiaries of these conflicts: the animals, membership rolls and profits of activist groups, or industry? Would more progress be made through collaborative education of consumers regarding the need for their support of animal welfare measures through paying higher prices for food? These prices would reflect increased costs to farmers, who should receive any increases from consumer spending. Revenue from any increased prices paid by consumers going to retailers or middle people/buyers do not benefit farmers. Would acceptance of conventional management practices be appropriate to ensure low income people have the capacity to pay for food animal products rather than cheap high calorie plant based products (e.g., refined sugar, high fructose corn syrup) that are claimed to contribute to our obesity epidemic? Try an experiment: take \$20, go to the store and buy fresh fruits, vegetables, eggs, dairy and meat products, and count the calories and major nutrients; do likewise for purchases of the cheapest processed or Afast® foods and soft drinks. Is there a difference in total calories and other nutrients?

Speakers will address some of these questions. All of these questions, and more, will be answered by the food animal system and others in the future. Many people believe that consumers, informed through holistic educational programs, should be central to decisions that

answer these questions. It is essential we have the ability to balance the best interests of food animals and society in our decisions, rather than the goal-oriented philosophies of some participants in these debates. Good stewardship implies use of, and respect for, the animals in our care. More radical components of the animal rights movement continue to clamor for increased violence, and are convinced of the need for what others see as misguided persecution of those who use animals. Moderate animal welfare groups are a valued component of food animal production, and continue to present a viable alternative for food animal production and use, versus the stated (and unstated) goal of abolition of animal use by some corporate entities.

The Preface from the 2006 Future Trends in Animal Agriculture symposium, *Addressing International Trade Complexities of Animal Welfare* contains additional thoughts about our relationships with each other, on individual and organizational levels, and how this situation affects our ability to create meaningful cooperative programs. We can only make significant progress in addressing challenges in animal production and processing by honestly finding common ground and implementing programs for the benefit of animals and society. Retention of organizational polarization, positional bargaining to *have it your way*, or manipulation of situations through the incremental approach to change and the facade of *common ground*, does not necessarily benefit the animals for whom we have stewardship responsibilities. Negative attitudes primarily benefit the financial success of organizations, membership recruitment (profit), or the status quo. No management system is perfect, and each system has supporters and detractors. If society wants a particular system used for food animal production it seems important they understand the implications of their demands on animals, farmers, cost of their food, and on the rural structure if farmers are forced out of business. Hopefully, the presentations from the 2007 symposium will continue to help us better understand the consequences of our actions and desires, or inaction. Perhaps we can incorporate the lessons of previous attempts into how to best interact with each other and to collectively make improvements for animals based on true consumer demand (what consumers do, not what they say in surveys).

Agriculture continues to adjust to market and societal demands. There have been significant changes in the pork industry and veal industry within the last year. Group housing has been embraced as a viable management option. Influential members of these industries will be moving toward conversion of production facilities to group housing. Poultry and hog processors continue to evaluate various gas mixtures to stun/kill the animals. The OIE is emerging as the dominant global decision-making entity regarding animal welfare (not rights) issues. The USA, through the USDA/APHIS, continues to participate in these discussions to ensure that opinions of our industries and all stakeholders are heard.

The purpose of the symposium is to briefly present information from government representatives, and the perspectives of industry, animal advocacy organizations, and university personnel on the future structure of animal agriculture and the impact of that structure on our capacity to properly produce food animals. Included in the discussions are the roles of government agencies, Land Grant Universities, and stakeholders regarding assistance and leadership. We will also look at existing attitudes of consumers, the impact of proposed animal welfare standards and of biotechnology, and animal welfare considerations of outsourcing food animal production.

We are honored to have Mr. Charles Conner, Deputy Secretary of Agriculture with us to provide the Introductory Comments.

The **Mission** of the FTAA is to foster and enhance balanced and enlightened public dialogue on topics related to the nature and future of animal agriculture.

The **Vision** is: to develop programs that are inclusive and national in scope, with the committee consisting of individuals from organizations representing academia, agribusiness, animal welfare, environment, university, government and others. The FTAA seeks to present timely issues in a balanced, innovative and thoughtful manner. The Committee also seeks to enhance public dialogue and understanding about the nature and future direction of animal agriculture, and the impact of their personal decisions on this process.

FTAA **Goals** are: 1. To facilitate genuine collaboration and the ability of farmers to produce food for society, while improving animal well-being. 2. To provide opportunities for dialogue and understanding of animal well-being, environmental and other issues in an atmosphere of mutual respect of consumers, farmers, advocates, commodity organizations, and others. 3. To provide information to identify critical animal production issues and enhance greater understanding of societal desires and trends that impact production agriculture.

Welcome

Richard Reynnells
USDA/CSREES/PAS
Washington, DC

On behalf of the organizing committee for the Future Trends in Animal Agriculture (FTAA), I want to welcome you to the 2007 symposium, "Food Animal Agriculture in 2020". The purpose of this symposium is to provide the opinions of speakers regarding the status and structure of animal agriculture, primarily focused in the United States, in a short 13 years. We will look at how food animal production and processing will or should look depending on your personal or organizational philosophy or goals. Reality will depend on numerous factors, such as: international trade issues related to the welfare of food animals; leadership in industry, animal welfare, and animal rights corporations and organizations; the interaction of these entities with consumers and government personnel; the success of state ballot initiatives and county/village decisions; and environmental restrictions. This symposium provides the vision of persons in advocacy and industry organizations, academia, and government, regarding the stewardship and uses of food animals, and related questions of the structure of agriculture.

Presentations include: comments from a noted author who has studied the structure of agriculture from an economic perspective for many years and offers a potential solution to current problems; divergent views from animal activists and industry regarding what animal agriculture should look like in the future; and a viewpoint as to how USDA should help mediate the discussion of animal production and processing in the future. Regardless of what some people promote, science does have an ethical basis, and it is influenced by internal and external philosophical and ethical viewpoints. Many in the industry agree that food animal production systems can be improved without being a threat to animal production and food security, and we will hear of potential solutions to this issue. Information that creates or facilitates changes in food animal production, and results in the betterment of society are often the product of our Land Grant Universities. This support system will be critical in the future, including providing input to the development of global standards for animal production. Outsourcing food animal production and what will happen to our ability to influence animal welfare in other countries, and our retention of a minimum level of food security, will be discussed. The structure of agriculture, as evaluated by the National Commission on Industrial Farm Animal Production (better known as the Pew Foundation Study) will be summarized. A discussion of how, or if, we should implement highly sophisticated scientific procedures as part of our commitment to animal welfare and a viable animal production system will complete the day.

The FTAA organizing committee is Co-Coordinated by David Brubaker, Agri-Business Consultant; Kay Johnson, Animal Agriculture Alliance; Ken Klippen, Klippen and Associates; Richard Wood, Food Animal Concerns Trust; and, Richard Reynnells, United States Department of Agriculture (USDA), Cooperative State Research, Education and Extension Service (CSREES), Plant and Animal Systems (PAS). The FTAA organizing committee is comprised of representatives from several animal welfare and industry organizations, universities, USDA, and others. These individuals represent various views on animal production and work together to bring about positive benefits for animal agriculture and society.

The need for everyone to understand animal welfare issues is clear, but this has been complicated by the numerous animal welfare and animal rights philosophies. The Future Trends in Animal Agriculture continues in our tradition of attempting to define issues of concern and then develop programs to allow persons to cooperate in discussions of the issues and to examine potential alternative solutions to problems. The Mission, Vision and Goals of the Future Trends committee are outlined in the proceedings.

The organizing committee gratefully acknowledges support from several entities that allowed the symposium to take place, particularly the contributions of speakers for their significant time and effort, with some waiving the requirement for reimbursement of expenses. Financial support by the USDA Animal and Plant Health Inspection Service and USDA Cooperative State Research, Education and Extension Service, with the Humane Society of the United States providing the coffee break and room arrangements, and the Animal Agriculture Alliance for duplication of the audiotapes, facilitated our ability to provide this important opportunity for improved networking and understanding.

The proceedings include speaker contact information, which is provided as an Appendix. The primary audience members are: agency decision makers and other government personnel, representatives from animal advocacy organizations, universities, the agricultural industries, and congressional staffers. The public is welcome to attend all FTAA events. We hope that you find the proceedings enjoyable and educational. Feel free to contact any committee member for details of future programs. Contact me at 202.401.5352 for additional copies of the proceedings from this or previous years.

Please remember to fill out your evaluation form. We require your ideas to improve programs in the future.

Please note we have to adhere to a strict schedule to ensure all speakers have their allotted time. Therefore, please limit your questions to 30 seconds or less. Speakers will likewise stay within their time limitations and provide complete yet concise answers to questions. We appreciate your cooperation.

Deputy Secretary of Agriculture, Charles Conner, will provide introductory comments. Before his current assignment, Mr. Conner held numerous positions of importance, including several key leadership staff positions on the Senate Agriculture, Nutrition and Forestry committee. He was also a Special Assistant to the President for Agricultural Trade and Food Assistance. Perhaps of greatest significance is his farm background, where he gained first-hand knowledge of the proper treatment of animals and the complex symbiotic interrelationship between animal and crop production, and societal demands. His brother still operates the family farm in Benton County, Indiana. His strong agriculture background resulted in his deep respect for the land, the people who work it, and the animals. He has generously agreed to spend a few moments to welcome you and to share his thoughts on today's topic. Please welcome Deputy Secretary Conner.

What Should/Could Food Animal Agriculture Look Like in 2020?

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INTRODUCTION

Food animal producers are in the middle of a dynamic economic sector that is undergoing significant changes which will continue for decades. Livestock producers are between suppliers of feed (and other inputs) and animal processors in the flow of products within the meat product sector, and all of the industries in this sector are shifting in structure. Structural shifts cause changes in both the conduct and performance of an industry, thus many changes will occur in food animal agriculture by 2020. Probably the most important shift is the ongoing concentration of animal processing firms. The structural shifts caused by the concentration of buyers for livestock (i.e., animal processing firms) are enabling the exercise of market power, which hastens the shifts in structure, thus the shifts are inevitable. The ultimate result of these changes is that integrated vertical supply chains will grow more common and stronger by 2020. This could have serious implications for American livestock producers and, possibly, consumers.

The general objective of this paper is to contribute to the understanding of both the economic issues behind the changing structure of livestock industries, and the likely implications of those changes for food animal agriculture as it will exist in 2020. In this effort I pursue two specific objectives. First, I summarize the limited amount of data available at this early stage in the trend toward increased use of market power, proposing an explanation for what is driving that trend. My second specific objective is to present the implications of the trends in industry structural changes. Based on a discussion of previous research results, I draw preliminary inferences on the future of animal agriculture in America's potential for success as well as the fundamental limitations for livestock producers.

VERTICAL COORDINATION IN AGRICULTURE

The structure, conduct, and performance of American agriculture are continually changing. This may be most easily seen in agribusiness industries where firms are becoming larger and more industrialized, causing industries to become more concentrated. This change in agribusiness structure is being driven partly by economies of scale. Conversely, the location-specific nature of agricultural production (which is driven by the comparative advantage of natural resources and micro-climates) is likely to prevent that industry from becoming as concentrated as agribusiness industries, thus the current imbalance in the bargaining positions of commodity sellers and buyers is expected to get worse in the future. The structural changes leading to concentration, in turn, are likely to change the conduct of commodity markets such that the economic performance of the two industries will be affected, with the agribusiness industry expected to benefit at the expense of the production industry.

One of the ways this change in commodity market conduct is manifesting itself is through the increasing use of production and marketing contracts between agribusiness firms and farmers or ranchers. The trend of increasing contracting was slow to start, but has become more

important over the last decade. The overall share of agricultural production value under contract in the U.S. has increased from 12 percent in 1969 to 39 percent in 2003 (MacDonald and Korb). Production and marketing contracts are two methods of vertical coordination. Thus, it has long been hypothesized that the use of these contracts, especially production contracts, is an indicator of industrialization in agriculture (e.g., Mighell and Jones; Drabenstott; Ahearn *et al.*, 2005).

Vertical coordination refers to the synchronization of successive stages of production and marketing, with respect to quantity, quality, and timing of product flows (Martinez 2002). A production contract offers more control to a contractor than does a marketing contract, but both types of contracts offer only partial control compared to complete vertical integration achieved through common ownership of production and marketing activities at successive stages of the supply chain. A processor firm seeking complete control may prefer vertical integration over the partial control of contracts, *ceteris paribus*. However, farmers and ranchers prefer to be independent operators (Key, 2005) ideally selling their commodities in spot markets, such as auctions.¹ Thus, the actual distribution of production being sold in spot markets versus through contracts may indicate (among other factors) the relative market power of market participants.

Contracts formed between agricultural producers and processors replace traditional spot markets for all parties involved. According to results from the USDA's Agricultural Resource and Management Survey (ARMS), contract use is expanding in the United States. The total share of production value under contract has increased from 28.9 percent in 1991 to 39.1 percent in 2003. However, there are two different categories of agricultural contracts.

Under marketing contracts, prices, quantities, and delivery schedules are agreed upon before crops are harvested or livestock are delivered. Agricultural producers own their commodities throughout the entire stage of production and therefore they retain control over management decisions, including those related to inputs used in production. Katchova and Miranda (p. 101) found that personal and farm characteristics mostly affect the adoption decision rather than the quantity, frequency, and contract type decisions. Marketing contracts cover a greater share of crop production than livestock production, with 29.7 percent of total crop production value under marketing contracting compared to 13.7 percent of livestock production value in 2003. For all commodities produced in the United States, the total share of production value under marketing contracts has been about 21 percent since 1994 (MacDonald and Korb).

Under production contracts, the commodity buyer sets specific input specifications and typically provides inputs such as veterinary services, feed, and young animals in the case of livestock. In some cases, the buyer owns the commodity being produced from the beginning of the contract period and has managerial control over the production process. In all cases, the producer provides technical and managerial inputs plus all labor and physical facilities needed to create the specified output. Additionally, the producer's payment is not agreed upon prior to the harvest/delivery but rather is determined at the end of the arrangement and is based on quantity and the degree to which the final product meets the buyer's specifications. Production contracts are much more prevalent among livestock commodities than they are among crops. In 2003 only 1.1 percent of total crop production value was under production contracts, compared to 33.7 percent for livestock. Furthermore, the share of total U.S. agricultural sales under production contracts increased from 10.6 percent in 1996 to about 18 percent in 2003, in

¹ Producers do not like selling in uncertain spot markets, but they prefer competitive spot markets to imperfectly competitive markets in which they are at a disadvantage relative to the buyers they face.

contrast to the stable trend in marketing contracts (MacDonald and Korb). Table 1 summarizes the share of production under contract by commodity and contract type for recent years. Given that producers lose some of their autonomy under the terms of production contracts, their choosing these contracts over spot markets is somewhat surprising, thus justifying a quick review of producers' motivation.

PRODUCER MOTIVES FOR PRODUCTION CONTRACTING

Over the last five decades the literature has offered a fairly consistent list of motives for agricultural producers to choose contracting, but there has been no consistency in opinions of which motives are most important. In 1963, Mighell and Jones identified four reasons for coordinating by non-market means: to increase efficiency, to obtain (or reduce the cost of) financing, to reduce uncertainty, and to gain market advantage. In 2005, Ahearn *et al.* (2005) said the two most commonly cited reasons for entering into contracts were risk management and minimization of production and/or transaction costs. These two reasons for contracting are essentially the same as the first three listed by Mighell and Jones, with efficiency gains and financing being lumped under the production-transaction cost minimization umbrella. Some recent studies (e.g., Allen and Lueck; Martinez, 2002) have focused on the single explanation of transaction cost economics (Williamson, 1979) and its emphasis on asset specificity as the driving force behind the decision to contract. For example, Lajili *et al.* (p. 279) found that the degree of asset specificity significantly influences farmers' choices of contractual arrangements.⁶ However, as pointed out by MacDonald *et al.* (2004a; p.745), a weakness of transaction-cost analyses is that they typically don't nest market power and efficiency explanations. In Joskow's summary, they frequently ignore the possibility that there may be market power motivations or market power consequences for these organizational arrangements as well.⁶ Surprisingly, Mighell and Jones' fourth motive cited, to gain market advantage, has received the least research attention although it is argued here that it is the most likely explanation in American agriculture's current evolutionary state.

Gaining a market advantage may be easy in an industry like agriculture which has imbalances in its structure (such as having many sellers and few buyers of a commodity). For example, in 1960 Lanzillotti detailed how firms dealing with agriculture were already taking advantage of the production sector. He concluded that leading firms possess considerable market power and are inclined to utilize such power to manage or administer their market situation⁶ (pp 1240-1241). The result of that market power imbalance was a significant difference in the profit margins of agribusiness firms and agricultural producers. In other words, gaining market power facilitates taking actions that improve a firm's profit margins, thus providing the strongest of incentives to seek bargaining power. As a result, it is surprising that relatively little empirical research was done to sort out the relationship between industry structure and market power.

By 1986 the story was still unsettled, as reported by Schrader (p. 1161):

The relation of integration or nonmarket vertical coordination to market power has two interpretations. Integration and contract coordination are viewed by some as a means to enhance the integrator's market power. Others see market power on one side (or both sides) of a market as an incentive for vertical arrangements to capture gains from the side possessing market power or to achieve joint profit maximization.⁶

The uncertainty was still apparent in 2005 when Ahearn *et al.* (2005) reported on the increasing concentration in agriculture and agribusiness and noted that it is not obvious whether this

concentration is the desirable result of cost efficiencies in production or the undesirable result of market power on the part of various players in the supply chain,² citing the question raised by Williamson (1968). Thus, more research is needed on the influence of agricultural market structure on conduct such as contracting.

There is little literature dealing directly with the recent rise in production contracting. This is due partly to the scarcity of data on contracting (Ahearn *et al.*, 2005). A review of the scant literature points to three possible explanations for the increased share of production under production contracts. These are risk aversion, the increase in processor concentration in U.S. agribusiness, and the increase in the total scale of agricultural production. While risk management is virtually undisputed in the literature as a catalyst for contracting in general, MacDonald *et al.* (2004b), and Key (2004) stress that it should no longer be considered the sole motivating factor for farmers in choosing production contracts. The respective causal relationships between the increase in processor concentration and the increase in the scale of production with production contracting are less clear, but it is proposed here that concentration and size lead to market power that is used to expand contracting.

A defining characteristic of the ongoing transformation of U.S. agriculture may be the rise in concentration in the food manufacturing industry (Ollinger *et al.*). According to data from the USDA, the mean industry four-firm concentration ratio (CR4) in food manufacturing has risen from 35 percent in 1982 to 46.1 percent in 1997.² The rate of increase in concentration for the meatpacking industry, in which there is also the highest degree of production contracting, significantly outpaced agriculture as a whole. The meatpacking CR4 increased from 29 percent to 57 percent over this time period. This trend continues in various processing industries. For example, the CR4 of U.S. beef packers was estimated at 81 percent in 2002 and the CR4 for pork packers in 2002 was found to be 64 percent. Table 2 presents CR4 data for a cross section of commodities over time.

Given that commodity producers have a strong preference for autonomy (Key, 2005), the observed increase in processor concentration suggests that bargaining power on the part of agricultural producers is decreasing, thus fueling the trend in production contracting. This certainly appears to be the case in the hog industry where producers who value autonomy less than they fear the risks of being without a contract eagerly adopt contracts (Davis and Gillespie). However, there are exceptions to this argument. For example, the soybean processing industry saw an increase in concentration from 1982 to 2002, yet only a small portion of total soybean production is under any form of contract, as indicated in Table 1. The broiler industry has by far the largest share of production under production contract, yet among livestock commodities it has both the lowest CR4 and the slowest growth in concentration over the comparable time period.

Producer concentration is also on the rise in U.S. agriculture. According to USDA data, the percentage of farms in the United States with annual sales of \$500,000 or more has increased from 2 percent in 1991 to 4.4 percent in 2001. More strikingly, these farms' share of total agricultural production increased over this period from 39 percent to 57.4 percent. Examining individual commodities, Rios and Gray determined that the share of industry total sales from farms with annual sales of \$500,000 or higher increased from 10.9 percent to 77 percent for hogs from 1982 to 2002. Production contracting is relatively very high for hog production, even

² CR4 is the concentration ratio measured using sales data from the four largest firms in the industry. It is the percentage of total industry sales revenues that are accounted for by the four largest firms. CR8 and CR20 are also used in some analyses.

though the rate of growth in hog producer concentration significantly outpaced the equivalent numbers for commodities with low production contracting, such as wheat, corn, and soybeans. Just as increased processor concentration implies increased buyer bargaining power, increased producer concentration would normally suggest increased seller bargaining power. However, concentration of hog producers may be an outcome caused by the trend of processors offering contracts most often to larger producers only. Thus, the hog industry case indicates there are some commodity-specific factors influencing the level of production contracting and the direction of causality in that contracting (Key and McBride).

Due largely to the location-specific nature of agricultural production, the food manufacturing sector is likely to consolidate faster than the commodity production sector. That is what happened in the United Kingdom (Duranton and Overman). However, concentration in the American manufacturing industry is not the primary determinant of the pattern of production contracting, particularly when considering the current trends in producer concentration. Clearly, many factors are significant, as noted below.

Key (2004) examined the supply side of agribusiness by evaluating the relationship between the scale of production and contracting. The scale of production, as measured by changes in the size and output of the largest farms by sector, was found to be directly correlated with the prevalence of contracting. Explanations offered by Key for this correlation included the usual stories of grower risk aversion and contractor transaction costs, as well as newer theoretical justifications such as asset specificity.

Finally, another possible determinant of contracting is the growth of production contracting itself. Recent research suggests that farmers in some commodity markets are turning to contracting out of necessity due to the incomplete markets created by other market participants= decision to contract (Young and Burke). Roberts and Key demonstrated that in some markets, farmers who choose to engage in production contracts could impose negative externalities on other farmers in the form of increased search and transaction costs. The farmers facing the externalities are induced to enter into contracts, which they would not have done otherwise, because contracts may represent the only available access to a buyer. This finding is consistent with the idea that spot markets have tipping points@ at which a market is thinned enough to induce all remaining participants to enter into contracts (MacDonald *et al.*).

It is clear from the literature that questions still remain as to the primary determinants of production contracting in agriculture. Also, much is yet unknown regarding the effects of contracting on producers, agribusiness, and consumers. Yet, it is understood that contracting has played a large role in improving product consistency and traceability throughout the stages of food production (MacDonald, *et al.*, 2004b). Furthermore, research has shown that contracting has a positive effect on farm productivity (Ahearn, *et al.* (2002); Key and McBride; Morrison Paul, *et al.*). There remain concerns over the effects on producers who enter into contracts against their best interests (Roberts and Key), and the managerial control imposed on producers by the processors with whom they contract (Farm Foundation). However, much of the rise in production contracting has occurred in just the past decade, suggesting that it may take years for the large-scale effects of production contracting to become evident in empirical analyses across a wide range of commodities.

FARM-LEVEL ANALYSIS

Several hypotheses about the influence of production contracting on the size, structure, and financial position of production operations are tested here using farm-level survey data. I compare producers who have production contracts with those who remain independent. Based on the literature (e.g., Key, 2004; Roberts and Key; Morrison Paul *et al.*) I hypothesize that producers entering into production contracts are likely to be larger than independents, significantly less diversified in terms of commodities produced, and facing increased risk, relative to the risk exposure of independents. I conduct independent-sample *t*-tests of these and related hypotheses for a cross section of commodities. Using pooled farm-level data from the USDA's Agricultural Resource Management Survey for the years 1996 through 2004 (USDA/ERS) gives a total of 95,517 observations.

The share of total sales under production contract varies greatly among commodities in the United States. I examined 14 major U.S. commodities for which adequate data were available and found that a continuum exists with regards to production contracting, ranging from virtually all production being under contract for broilers to no production contracting in the case of tobacco. Also, previous research has found significant differences between firms that enter into production contracts and those that remain independent (Key, 2004).

A small sample of commodities was evaluated in more detail to enable formal tests of hypotheses about differences in farm characteristics between production contractors and independent producers. Table 3 presents various statistics, by commodity, and the results of independent-sample *t*-tests of differences in the reported average values for the two groups. Several patterns appear across the results, as described below.

The first hypothesis tested is that production contractors have a higher per farm output of the relevant commodity than do independent operators. The results are shown in the two rows labeled *Asales of the commodity* in Table 3. The values are the annual average sales of only the commodity of interest, not total farm sales. For example, of the operators surveyed who produce broilers, those with contracts covering broiler production averaged \$675,979 in broiler sales annually from 1996-2004. In contrast, independent broiler producers sold only \$27,513 worth of the commodity annually, on average. For all of the commodities listed in Table 3, contractors produce significantly greater quantities per farm than do independents, on average. Also, in each case the *t*-test indicates that the difference in average sales is statistically significant, thus supporting the hypothesis. One implication of this result is that having a production contract may encourage operators to expand the scale of their output of the contracted commodity, although the direction of causality could be the reverse; producers who want to go large-scale adopt contracts to share risk, reduce transaction costs, and share managerial responsibilities.³

The result above leads to a second hypothesis, that firms with production contracts will be more specialized, less diversified, in their commodity output. Diversification is a tool used by producers to reduce risks, so the implication is that having a production contract substitutes for diversification as a risk management tool. In Table 3, the commodity share of total sales is used as a measure of specialization. For all the commodities listed, contractors get a higher

³ The risk-reducing character of production contracts may enable producers to comfortably expand their operations to achieve economies of scale. For example, Key and McBride found that for hog producers the use of production contracts is associated with a substantial increase in factor productivity, and represents a technological improvement over independent production.

share of their total sales from the contracted commodity. As anticipated, livestock contractors are significantly less diversified than are independent producers. Moreover, as the percentage of producers engaged in production contracts increases among livestock commodities, the degree of diversification decreases. These results support the hypothesis, especially for livestock producers.

The limited data available here do not make it possible to directly test whether or not livestock producers are yielding net economic benefits from production contracts. However, the statistics in Table 3 show that among livestock commodities average total income and average farm net worth for contractors decrease in both absolute terms and relative to independent producers as the share of production contracting increases and diversification decreases. Both broiler and cattle producers earn the majority of their total household income off the farm, in contrast to independents. The debt-to-asset ratio is a commonly used measure of financial risk for producers and livestock contractors have a significantly higher ratio than do independent producers. In general, these results indicate that livestock operations using production contracts are larger, but less profitable, than independent operators and face slightly more financial risk. However, these observations vary inversely with the physical size of the animal involved, applying most strongly to broilers and to a lesser extent to hogs and then cattle.

Crop producers using production contracts are less diversified than are independents, on average, but the differences between the two categories of producers are smaller in the case of crops than they are between livestock producer categories. Also in contrast to the relationships governing livestock production, crop contractors typically have significantly greater household income and net worth than do independents, plus significantly smaller shares of income coming from off-farm sources.

The most readily apparent difference between the livestock and crop commodity markets is that production contracting is a less popular choice among crop producers, as noted in the existing literature. Among all the crop commodities in Table 3, the percentage of farmers using production contracts is less than one percent.

Crop contractors produce significantly greater quantities of the commodities contracted than independents, as was true in livestock markets, but the average differences are considerably smaller in magnitude. Among crop contractors, commodity sales exceed those of independents by 55.5 percent on average, while the equivalent margin for livestock producers is 94.0 percent. In turn, crop contractors are more specialized than are independent crop producers, but crop contractors are more likely than livestock contractors to rely on some combination of contracting and diversification to manage risk.

Formal hypothesis testing on the financial net benefits of contracting is not possible with the limited data available, but our preliminary empirical results suggest that crop contractors reap greater benefits from production contracting than do livestock contractors. This may reflect the difference in producer bargaining power in livestock versus crop markets, with crop producers having more products made from their commodity, thus having more buyers available to them than do livestock producers. Risk, as measured by the debt-to-asset ratio, appears to be a significant motivating factor in favor of using production contracts in the case of livestock producers, but the same cannot be said for crop producers. Finally, these and other circumstances have changed across commodity markets over the past decade as markets have become increasingly concentrated, especially within the livestock sector. Thus, this study has

raised many hypotheses to be tested in the future as more data on production contracting become available.

HOG CASE STUDY RESULTS

The hog industry has been the subject of much research on changes in livestock industry structure and the trend toward increased production contracting (e.g., Bessler and Akleman; Key and McBride; Martin; Martinez, 1999; Ollinger *et al.*). Thus, it is used here to illustrate the relationship between livestock production contractors and independent producers.

The most important observation is that over the period from 1996 through 2004, the percentage of hog producers using production contracts has increased steadily. The share of total hog production under contract increased even more drastically, reaching 87 percent in 2004. As production contracting increased in scale, the diversification of the hog contractors decreased steadily, both in absolute terms and relative to independent hog producers. This means that the shift in hog industry structure toward most farm-level output being under production contract appears to have had the effect of substituting contracts for diversification as a risk management strategy for most hog producers. This may partly explain why production contractors had higher debt ratios than independents over most years. Although the data cannot answer the question of whether contractors have higher debts because they think that contracts reduce their financial risk exposure, or whether the higher debt ratios reflect the higher capital requirements of a larger, more-specialized hog operation, it is expected that both explanations are partly accurate.

The financial performance data available contradict the hypothesis that contracts reduce producers' financial risk exposure. During most years in the 1996-2004 period, contractors and independent hog producers were statistically equivalent in terms of average Net Farm Income. However, despite significantly higher sales of hogs and total farm sales, the average farm net worth of contractors has never significantly exceeded that of independents. Thus, production contracts have not led to higher wealth. Also, the fact that hog production contractors are steadily decreasing their share of off-farm income, indicates that the larger scale of operations needed under contract has led to more specialized hog operations, leaving less time for off-farm income opportunities. This combined degree of household income specialization may give contract hog producers a *higher* degree of financial risk exposure than that faced by independent hog producers. This is apparent when comparing the standard deviations of the average Net Farm Income over the nine years: it is \$48,260 for contractors and \$15,016 for independent hog producers. Thus, the structural change which has led to increased production contracting has not significantly improved contractors' income, compared to independent operators, but it may have increased their exposure to income risk. Therefore, hog production contractors may be worse off financially, on average. This raises the interesting question: do hog producers accept contracts because they think the productivity improvements found by Key and McBride will lead to improved profitability, or do they generally consent to the contract because they do not have the bargaining power to resist the demands of their buyers, as implied by Davis and Gillespie?

IMPLICATIONS OF THE CONTRACTING RESULTS

The preliminary empirical results here generally show that production contracts lead to production specialization which, in turn, may reduce off-farm income opportunities, both of which can increase the income risk of producers. This is an important observation because it

contradicts one of the main arguments used to justify production contracting. Proponents of contracting and much of the theoretical literature have said that producers can use contracts to reduce risk, which is true. For the small cross section of commodities evaluated here, the reality is that contractors have higher sales totals and higher income variance than do independent producers, but not necessarily higher income levels, on average.

It has been argued in the literature that buyer bargaining power increases with industrialization and that the potential for industrialization is influenced by a commodity's physical attributes (e.g., Sheldon). In particular, it has been well established that livestock processing industries have scale economies that encourage continued industrialization and that the resulting industry concentration of the last few decades has facilitated increased use of production contracts in those markets (Ahearn *et al.*, 2005; Bhuyan; Drabenstott; Key, 2004; MacDonald and Korb; Morrison Paul, 1999, 2000, 2001). In crop industries, however, production contracting is rare in most markets, although marketing contracts cover a majority of output in some markets (MacDonald and Korb). These differences across commodity types were apparent in the analysis here and raise questions for future research.

Looking to the future, the results of this preliminary study indicate that production contracting is likely to continue expanding to cover a higher share of total output for many commodities. This is an incentive for producers to form cooperatives or to use some other type of collective selling arrangements. However, cooperatives, bargaining associations, and other selling arrangements employ a type of production contract with supplier-members. Therefore, all trends indicate it may be increasingly difficult for producers to maintain their independence in the industrialized agriculture of America's future.

BLENDING ANIMAL AGRICULTURE AND AGRIBUSINESS FOR SUCCESS

Thus far, this paper has presented a picture that is bright for the American agribusiness sector, but bleak for the agricultural production sector. However, this is not the end of the story. Both sectors can survive in the future if industry participants take a slightly different perspective when viewing those in the other sector. It is argued in this section that blending American agriculture and agribusiness may be essential for success in the future (especially for the production sector) but, if accomplished, the resulting agri-food industry will play the leading role in the global market. In doing so, the new industry can create a truly 'economically sustainable agriculture' in America, whereas none exists currently without policy interventions.

To begin, the concept of 'blending' agricultural production and agribusiness is described. A blended industry, in the simplest sense, is one in which all participants understand and appreciate their mutual dependence on all other participants. No matter what form of vertical governance is used to blend firms into a coordinated system, the key point is that everyone in the system knows that it will fail without the contributions of each participant. Thus, everyone knows that their economic rewards depend in part on the performance of others in the system.

Existing examples of a blended industry include the horticulture-nursery and the dairy-milk industries. In the first case, the horticultural participants are farmers producing plants that the nursery participants sell through wholesale and retail outlets. Without the plants, the nurseries have nothing to sell, and without the nurseries, the farmers have no market outlet. Each group needs the other. In the second case, dairy farmers produce raw milk that is processed, packaged, and distributed by the second group of participants. Again, each group needs the other. As a result, there is much communication and cooperation between the groups. The first

group seeks to deliver a product that facilitates the input needs of the second group. That is possible because the second group carefully communicates its needs to the first group. In essence, the groups *try* to blend their activities into a seamless whole that has the best chance of successfully meeting the demands of consumers.

These two examples of a blended industry are similar in that the product's form is changed little in a vertical system that is *short* from top to bottom. In this short vertical system it is relatively easy for participants to both see how the other group contributes to the whole and to communicate with each other. However, in the future, some blended industries must be very *tall* to serve their product markets, thus making it much more difficult for system participants to recognize and appreciate the contributions of all other participants. This is the challenge driving current market evolution.

THE CURRENT SITUATION

What is the current situation in the market evolutionary process shaping American animal agriculture and agribusiness? In simple terms, America is at a turning point between two eras in the relationship between its production agriculture sector and its agribusiness sector. The first era is not yet over, but will be soon. What will end the first era, and what will differentiate the second era from the first, is a simple change in the perspective of industry participants toward members of the other sector. At present, both groups need the other, but they are in a *tug-of-war* when interacting, each seeking to maximize their own profits. This is a state of conflict, which is not sustainable.

Structural changes in American agricultural production are occurring in response to the increased globalization of commodity markets. Boehlje (p. 1028) summarizes the changes by saying *production is changing from an industry dominated by family-based, small-scale, relatively independent firms to one of larger firms that are more tightly aligned across the production and distribution value chain.* These changes are occurring against the wishes of many producers. As Key (2005) indicates, agricultural producers are very independent people, thus not eager to give up any control over their operations, if possible. Yet, that is what is happening at present. The agribusiness sector is using its market power to nudge producers into production and marketing contracts. As a result, there is lots of conflict in the interactions between the production and agribusiness sectors.

Some would argue that the basic nature of competition has changed in all industries in recent years, especially in terms of the definition of a market (Boehlje, p. 1030). He adds, A worldwide sourcing and selling has changed the geographic boundaries of markets from regional or national to global. In response, *A closer vertical coordination has occurred as the use of spot markets has declined, while production and marketing contracts, franchising, strategic alliances, joint ventures, and full vertical integration have increased (Young and Hobbs, p 428).*

This evolutionary change in markets for commodities makes it more difficult for independent farmers and ranchers to access buyers in a traditional negotiation, thus adding to the pressure on producers to align themselves with some new vertical coordination structure. Up to this point in time, most American producers have viewed these market changes as a threat. That perspective is understandable given the negative effects market changes have had thus far on producers' financial performance. However, that perspective could be the downfall of American agriculture.

The irony of the current situation is that if nothing changes current perspectives, the threat to producers posed by being forced to join a supply chain may be exceeded only by the threat of *not* being able to join a supply chain. As Young and Hobbs (p. 432) conclude,

Asome producers may have difficulty gaining entry to tightly coordinated supply chains. Entry may be difficult due to requirements for sophisticated production skills or the need for specialized equipment or capital. The inability of certain producers to gain entry to supply chains for these reasons would be a continuation of the forces that have prompted producers to exit from agriculture historically.®

Why would a producer have to exit from agriculture if he or she cannot join a supply chain? The answer is that as more supply chains develop in the future, the fewer participants there will be in traditional spot markets, thus those markets will erode and eventually disappear. In other words, spot markets are becoming thinner, which means they may be less likely to generate the competitive market prices needed to attract participants.

HOW THE PRODUCTION SECTOR CAN SURVIVE

In the long run, the survival of most American agricultural producers may depend on their willingness to be a contract supplier to an agribusiness that is successfully meeting consumers' demands for specific product attributes. More specifically, for the American production agriculture sector to survive in a future that will be full of new foreign competitors that have lower production costs, American producers will have to voluntarily blend with agribusiness in a Metasystem® aimed at improving the profits of each participant by improving the competitiveness of the U.S. agri-food firm versus foreign competitors. This strategy does not guarantee the survival of any particular firm or industry, but it is the only approach that adequately addresses the challenges faced by American agricultural producers and, thus, it offers a chance for prosperity.

The first challenge is the current state of conflict between producers and the agribusiness firms with which they deal. As long as agricultural producers view agribusiness as part of the problem, rather than as part of the solution, the conflict will continue and more producers will be forced to exit agriculture. On the other hand, if producers follow the old cliché, *If you can't beat 'em, join 'em,*® and replace the conflict with collaboration, they immediately raise their chances of survival. This is possible because market structures based on truly voluntary participation will be more successful in the long-run because they eliminate internal conflict.

A metasystem is a state of collaboration that helps address the second challenge faced by American agricultural producers: foreign competition. By design, metasystems add value to commodities and differentiate them from the output of competitors. A metasystem is a special type of supply chain. As noted earlier, a *Supply chain*® is an integrated vertical system across different functions in the process required to create and deliver a product to the consumer. Most metasystems focus on quality management. Caswell, Bredahl, and Hooker say that food quality metasystems are strategies that affect any quality attribute involving food safety, nutrition, value, packaging, or process. They say *Metasystems* are implemented through *metastandards*, which most often define a process to be undertaken by a company to assure quality on an on-going basis® (p. 549). Thus, a metasystem is an organized attempt to create and document quality differences in products. All firms in a metasystem willingly collaborate in this effort.

There are many benefits to participation in a metasystem. For example, Caswell, Bredahl, and Hooker say

In addition to affecting operation of the value chain, food quality metasystems are likely to confer significant marketing advantages on companies in selling to final consumers. These advantages come from selling a higher quality product and reliably being able to certify that quality to consumers who are willing to pay more. These advantages may enter the company's profit performance through a higher price or lower transaction costs (p. 552).

This ability to differentiate products based on higher quality attributes is a key weapon in the current conflict between American firms and the growing number of foreign competitors. As American producers lose the race to be the lowest-cost supplier of commodities, their salvation rests in being identified as the supplier of high-quality commodities as inputs to American agribusiness firms that create high-quality consumer products.

Metasystems are the future for the United States food industry. For example, Fouayzi, *et al.* found that over 90 percent of fresh-cut produce firms have adopted a quality management system because, among other reasons, it facilitates trade between firms. With such a system, long-term contracts are more likely between firms within a supply chain, and transaction costs are reduced.

The ability to make long-term contracts holds great value for producers in many commodity markets. For example, it would help reduce the chances of being held-up by processors. A major source of conflict in the current relationship between many producers and agribusiness. As Vukina and Leegomonchai (p. 589) explain, when only short-term contracts are available, commodity producers can be held-up by processors because growers' assets are a source of potentially appropriable quasi-rents in the sense that they have low salvage value outside the bilateral contractual relationship. This constitutes a hold-up problem that can manifest itself in two ways. First, appropriable quasi-rents affect the level of investments. Being aware of the possibility that they may be held-up by processors, growers will cautiously invest in specific assets. [Second, after] facilities have been constructed, the processor may exploit his advantageous bargaining position by frequently requesting upgrades and technological improvements as conditions for contract renewal.

As a result of the hold-up risk, producers under-invest in assets with specific uses (Castaneda). A long-term contract reduces the risk of hold-up and, in the process, reduces the state of conflict between producers and food manufacturing firms. The increased state of collaboration encourages producers to invest in more assets with specific uses, thus providing expanded output to agribusiness without those firms having to increase the number of contracts negotiated or supplier relationships maintained. This reduces transaction costs to all parties involved. The ability to sign long-term contracts also gives supply chain participants the ability to adopt many practices aimed at gaining a competitive advantage over other firms, such as time integration (Wilson and Thompson) and other innovations. However, at present it is usually agribusiness firms resisting the move to long-term contracts (e.g., in the broiler industry), so they are apparently not yet willing to accept the advantages of long-term contracts and move to a full metasystem.

In total, the economics of supply chains and their effects on the structure of agriculture seem to be positive for agribusiness and consumers, so at this point in time there is no reason to think

their growth will slow. Given this clear trend for agribusiness firms, agricultural producers need to decide sooner, rather than later, to join the team and enjoy the perks. Remaining in a state of conflict with agribusiness is a losing proposition. Unfortunately, the conflict may benefit agribusiness firms in some industries, so the path to integration will be bumpy.

The resistance of independent producers to joining a metasystem, or any other vertical market structure, is expected to continue for some time. To avoid dependence on an agribusiness, some farmers will continue to pursue the creation of their own supply chains, in the form of direct marketing to a niche market. In some places where large numbers of consumers are located close to talented farmers, niche markets will survive and generate adequate returns. In other places, potential niches are simply located too far from the farmer entrepreneur to enable the establishment of profitable operations. And finally, niches will fail in lots of places because the farmer did not realize that creating a supply chain meant that he would have to perform all the business and production functions himself. Sometimes when a producer talks about eliminating the middleman, it is because that producer does not appreciate that agribusiness firms exist because they add value to commodities and it is the processed product that consumers want, not just the commodity which was used as an input in creating the final product. Supply chains create a synergy; the sum is [in] greater [demand] than the [demand for the] parts.

Finally, survival of the American agricultural production sector depends on the ability of producers to adjust to a new business structure. Metasystems and other supply chain structures are changing the theory of the firm. As early as 1992 Barry *et al.* (p. 1219) observed that the needs for farm-level product differentiation put pressure on open market relationships and may lead to vertical integration or contracting between key stages in the market system. Farm-level product differentiation often requires specialized equipment, creating asset specificity, and asset specificity and vertical coordination are considered to be positively related. Greater asset specificity means greater transaction costs in redeployment, and a tendency toward more complex, long-term contracting and vertical integration (Barry *et al.*, p. 1221). Therefore, contracting continues to expand, as described earlier, changing the nature of relationships between market participants. For example, production contracts (and other vertical integration tools) create an agency relationship. The agent (producer) is expected to behave in concert with the objectives of the principals (buyers) so that these objectives can be optimally attained. This creates a situation in which the manager's task now involves selecting the boundaries of the firm (defined by contractual and asset control relationships) along with the more traditional tasks (Barry *et al.*, p. 1223). In other words, American agricultural producers must decide the extent to which they are going to voluntarily blend their firm with others in a supply chain.

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Table 1. Share of total agricultural sales by commodity, contract type, and year, 1991-2003

Item	1991-93	1994-95	1996-97	1998-2000	2001-02	2003
<i>Commodities Produced under Marketing Contract</i>	<i>Share of Total Sales (%)</i>					
All Commodities	17.0	21.2	21.5	20.4	19.7	21.7
Crops	22.8	24.0	21.1	22.5	24.7	29.7
Corn	10.2	13.8	12.9	12.6	14.7	13.8
Soybeans	9.6	9.8	13.2	9.7	9.5	13.5
Wheat	5.8	6.2	9.0	6.9	6.4	7.5
Sugar Beets	88.5	83.7	74.6	83.1	95.8	95.1
Rice	19.7	25.2	25.8	30.5	38.6	51.8
Peanuts	45.2	58.3	34.2	44.9	27.9	53.3
Tobacco	0.3	0.6	0.3	1.9	52.6	54.8
Cotton	30.4	44.4	33.8	42.9	52.6	50.9
Fruit	N/A	61.0	54.3	63.3	60.1	67.2
Vegetables	N/A	45.3	32.3	27.3	31.5	36.4
Other Crops	6.3	14.0	18.7	21.2	30.9	44.7
Livestock	11.6	18.2	22.0	18.4	14.5	13.7
Broilers	5.9	3.4	4.0	3.9	4.2	1.1
Hogs	N/A	2.4	2.7	9.1	6.1	6.8
Cattle	N/A	4.3	5.9	4.6	2.7	3.4
Other Livestock	0.1	6.8	4.9	10.7	3.5	7.4
Dairy	33.6	56.7	58.0	53.4	48.0	50.5

<i>Commodities Produced under Production Contract</i>	<i>Share of Total Sales (%)</i>					
All Commodities	11.8	13.0	10.6	16.9	18.0	17.5
Crops	1.9	1.9	1.8	4.2	3.1	1.1
Vegetables	N/A	9.7	6.1	12.4	10.6	6.3
Livestock	21.1	24.7	22.9	29.6	33.8	33.7
Broilers	82.8	81.2	80.1	84.9	88.1	95.5
Hogs	N/A	28.7	47.3	76.3	78.1	84.8
Cattle	N/A	14.7	11.1	19.7	18.3	25.4
Other Livestock	0.1	2.6	N/A	N/A	5.5	N/A
Dairy	0.2	0.2	0.1	0.2	0.7	0.6

Sources: MacDonald and Korb and the USDA's Agricultural Resource Management Survey for relevant years.

Table 2. Commodity Industry Concentration

Commodity	CR4 1987 %	CR4 1992 %	CR4 1997 %	CR4 2002 %
Broilers	29	34	56	54
Hogs	20	25	64	68
Cattle	39	50	84	86
Dairy	21	22	21	30
Soybeans	71	71	75	95
Corn	74	73	80	69
Wheat	44	56	62	49
Oats	27	33	64	70
Barley	19	23	46	87
Rice	41	51	69	57
Cotton	18	19	20	26
Sugar beets	83	85	85	85
Peanuts	68	80	82	87
Tobacco	70	76	83	89

Notes: "CR4" is the concentration ratio reported by the US Census Bureau for the major product category for the year indicated. The source for the CR4 and for the data used in the usage index calculations is the Census Bureau's 2002 *Economic Census*.

Table 3. Production Contracting in American Agriculture, Summary of Average Results per Farm, 1996-2004

	<i>Commodity</i>					
	Broilers	Hogs	Cattle	Corn	Soybeans	Cotton
Total number of producers surveyed	4,713	6,620	50,166	27,852	29,770	6,427
Farmers who Production Contract (%)	86.3	25.8	1.04	0.36	0.52	0.09
Contracting share of commodity sales (%)	95.5	78.7	18.6	0.77	1.44	0.12
Sales of the commodity, Contractors (\$)	675,979***	753,164***	631,546***	201,558***	130,994***	373,125***
Sales of the commodity, Independents (\$)	27,513	70,979	29,023	60,171	46,772	159,864
Total farm sales, Contractors (\$)	909,943***	1,329,973***	2,839,963*	558,902**	528,445**	720,208
Total farm sales, Independence (\$)	626,224	435,290	395,561	458,739	453,176	682,714
Commodity share of total sales, Contractors (%)	74.3***	56.6***	30.5***	36.3***	24.8	51.8***
Commodity share of total sales, Independents (%)	4.1	15.6	7.3	8.8	17.2	23.4
Total household income, Contractors (\$)	71,003***	104,172	158,879***	166,548**	125,191*	410,229*
Total household income, Independents (\$)	190,669	99,924	86,189	96,204	101,333	158,648
Off-farm share of income, Contractors (%)	58.2***	33.4	53.04***	28.3**	26.3*	6.4*
Off-farm share of income, Independents (%)	23.3	39.4	21.4	40.3	38.5	27.2
Farm net worth, Contractors (\$)	698,145***	894,956	981,894	1,220,000*	1,010,000*	2,180,000*
Farm net worth, Independents (\$)	899,987	940,565	975,049	939,469	882,686	922,669
Debt-to-Asset ratio, Contractors	0.26***	0.24***	0.31***	0.22	0.26**	0.08
Debt-to-Asset ration, Independents	0.14	0.18	0.18	0.31	0.53	0.17

Data source: the U.S. Department of Agriculture's Agricultural Resource Management Survey for the years 1996 through 2004.

***, **, * indicates a statistically significant difference between the mean values for producers who contract versus independent producers at the 99%, 95% and 90% confidence levels, respectively.

Panel: What Should Animal Agriculture Look Like?

Wayne Pacelle,
Humane Society of the United States
Washington, DC

Paper not provided. See Appendix C for the power point slides.

Panel: What Should Animal Agriculture Look Like?

Steve Kopperud,
Policy Directions, Inc.
Washington, DC

Paper not provided.

What Should the Role of APHIS Be in Food Animal Production

Andrea Morgan
USDA, Animal and Plant Health Inspection Service (APHIS)
Washington, DC

APHIS Statutory Authorities B Animals, Animal Products, Plants, and Plant Products

1. APHIS is America's first line of defense against agricultural threats. It's an action-oriented agency that works with other Federal agencies, Congress, the States, industry, and the general public to carry out its mission to protect the health and value of American agriculture and natural resources.®
2. To accomplish that mission, APHIS relies on its units to, among other things:
 - B Detect foreign animal and emerging diseases;
 - B Monitor disease trends and threats in the United States and other countries;
 - B Detect risk and evaluate disease control programs;
 - B Protect against plant pests and diseases; and
 - B Negotiate science-based trade standards.
1. APHIS has authority under the Animal Health Protection Act and the Plant Protection Act.
2. The Animal Health Protection Act gives APHIS the legal authority to act swiftly and decisively to protect U.S. animal health from a foreign pest or disease. APHIS has authority over importation and interstate movement of animals used for agricultural purposes, such as cattle, sheep, goats, swine, and poultry. The Act strengthens APHIS' ability to prosecute individuals who smuggle any animals or animal products into the country. It also gives APHIS legal authority to regulate animal aquaculture and provide services for aquaculture as for other animal livestock.
3. APHIS ensures that exotic animal and poultry diseases are not introduced into the United States by regulating animals and animal products. These efforts prevent the introduction of major foreign animal diseases (FADs) such as foot-and-mouth disease (FMD), classical swine fever and high pathogenicity avian influenza H5N1.
4. Because products consumed by humans for food can present animal health risks, APHIS regulates these products, but, by statute, our Agency's involvement and oversight of these food products is focused on protecting animal health.

Veterinary Services (VS)

- \$ APHIS Veterinary Services (VS) is an integral part of APHIS. VS= main mission is two-fold:
 - B Prevent, control, and eliminate animal diseases; and
 - B Monitor and promote animal health and productivity.

- These activities are vital to the health of U.S. cattle and livestock and to the safety of the U.S. food supply.

- \$ To accomplish its mission, VS plays several roles:
 - " Protects and improves the health, quality, and marketability of our nation=s animals, animal products, and veterinary biologics;
 - " Practices preventive veterinary medicine on a broad scale, dealing with animal health problems of State, regional, national, and international importance.

- VS= primary activities include: 1) Disease surveillance B through domestic programs as well as through surveillance for foreign animal diseases; 2) Import and export of live animals and animal products; 3) Veterinary biologics; and 4) Laboratory testing.

VS= National Programs

1. VS has programs to deal with various animal diseases and animal health issues on a national scale including:
 - " Diseases of aquaculture
 - " Low pathogenic avian influenza (LPAI)
 - " Pseudorabies
 - " Scrapie
 - " Chronic wasting disease (CWD)
 - " Bovine spongiform encephalopathy (BSE)
 - " Brucellosis
 - " Tuberculosis (TB)
 - " Johne=s disease
 - " Animal identification
 - " Veterinary accreditation

- VS commends the States= and stakeholders= contributions to its national programs and recognizes that the continued success of these programs depends upon cooperation. It takes a nation to protect animal health.

- \$ Without the work of State and Federal veterinarians in animal disease surveillance and response, the U.S. livestock and poultry industries, estimated to be worth about \$80 billion, would be seriously threatened.

- \$ VS has responded swiftly and effectively to incidents of animal diseases such as AI, TB, and vesicular stomatitis.
- \$ VS continues to develop and improve monitoring and surveillance programs in order to address animal diseases and promote trade of animals and animal products originating in the United States.

The Centers for Epidemiology and Animal Health (CEAH)

- CEAH, an World Organization for Animal Health (OIE) collaborating center in Fort Collins, Colorado, administers surveillance efforts for VS.
- CEAH's multidisciplinary staff of agriculture economists, spatial and computer specialists, and veterinary epidemiologists produces timely, factual information and knowledge about animal health.

CEAH's Center for Emerging Issues (CEI)

- CEI identifies and analyzes both emerging animal health issues and emerging market conditions for animal products.
- CEI's analytical projects range from work describing particular disease syndromes to work exploring the potential impact of climatic events and environmental concerns for animal health.
- Past projects have included studies on:
 - " BSE;
 - " Foot-and-mouth disease;
 - " FAD risks posed by travelers;
 - " El Nino's potential impact on disease occurrence.

Center for Veterinary Biologics (CVB)

1. Another important part of protecting animal health is regulating the production and use of veterinary biologics. To ensure that veterinary biologics available for the diagnosis, prevention, and treatment of animal diseases are pure, safe, potent, and effective, CVB in Ames, Iowa, regulates the following:
 - " Vaccines;
 - " Bacterins;
 - " Antisera;
 - " Diagnostic kits;
 - " Other products of biological origin.

1. CVB uses scientific information and regulatory processes to assure its customers that the veterinary biological products available for use are high quality. This Center also maintains pharmacovigilance by encouraging the reporting of adverse events occurring after the use of a veterinary biological product.

Zoonotic disease

- \$ Our mission is protecting animal health, and, through this mission, APHIS also plays a role in preventing the introduction and spread of zoonotic diseases.
- \$ Healthy animals ensure a safe, plentiful food supply, and can prevent the spread of zoonotic diseases to human populations.
- \$ APHIS veterinarians possess a unique perspective and knowledge that allows them to carry out a number of activities essential to animal health. For example, they can:
 - " Distinguish between diseases with similar symptoms such as exotic Newcastle disease, which is not transmissible to humans, and avian influenza (AI), which can be.
 - " Develop and implement strategies to prevent disease spread and eradicate disease outbreaks.
 - " Establish testing guidelines for disease diagnosis and prevention. I am pleased that APHIS has expanded the scope of many of our national disease programs, and we are conducting more testing and surveillance activities than ever before.
- Federal veterinarians involved at every levelCat headquarters, in the field, and in the laboratoryCwork tirelessly during animal disease outbreaks to:
 - " Gather surveillance samples;
 - " Test surveillance samples;
 - " Depopulate affected premises;
 - " Conduct epidemiological investigations;
 - " Provide scientific information to regulatory decision-makers and to stakeholders;
 - " Federal veterinarians also serve as liaisons with our livestock and poultry trading partners.

Surveillance Activities and Programs

- \$ Early detection is one of the keys to successful eradication of foreign animal diseases. Our foreign animal disease surveillance efforts include field investigations; disease specific surveillance programs; and accurate, rapid diagnostics in the laboratory.
- \$ Field investigations into suspected occurrences of foreign animal diseases are conducted by specially trained Federal, State, or privately accredited veterinarians.

- \$ APHIS conducts disease-specific surveillance for BSE, AI, exotic Newcastle disease, classical swine fever, and infectious salmon anemia.
- \$ APHIS has several eradication and certification programs that are in development or in early development stages including programs for CWD, Johne's disease, Trichinae, LPAI, and a scrapie flock certification program.
- \$ We also conduct many other programs aimed at domestic diseases, including brucellosis and tuberculosis. APHIS is improving slaughter surveillance for TB across the country. State status is tied to the level of slaughter surveillance, and APHIS has placed personnel in the major cow-kill plants to assist with sample collection and submission.
- The Cooperative State-Federal Brucellosis Eradication Program remains a priority for APHIS, and we continue to seek necessary funding. It is imperative that the program be as effective and efficient as possible.
- Working with State and industry representatives, APHIS is developing a new Brucellosis surveillance plan.
 - " Discussions on the plan, including laboratory consolidation, were held with National Assembly representatives this summer.
 - " Some changes in surveillance will require changes in regulations; therefore, it will be approximately 2 years before these changes could be implemented.
- APHIS has conducted BSE surveillance in the targeted cattle population since 1990. Currently, our goal is to collect 40,000 samples from the targeted population each year B a level that provides sufficient information to monitor the presence or absence of disease in the cattle population and that exceeds the international recommendations.

Collaboration with Other Agencies

- APHIS is a part of the safeguarding framework. The Food and Drug Administration (FDA), the Food Safety and Inspection Service (FSIS) and APHIS share oversight of animal products.
- We also strive to maintain good communication with FSIS and FDA by having monthly meetings to discuss mutual interests of concern such as:
 - Export and import certification issues
 - FSIS inspections of foreign establishments and animal health issues
 - Future regulations that could impact imports of meat products
 - Coordinating with Customs and Border Protection to insure that FSIS amenable

products are directed to FSIS inspection houses upon importation

- FSIS work at slaughter plants also plays an important role in many of APHIS disease control and eradication programs, since slaughter surveillance helps us detect and monitor the presence of diseases such as scrapie, TB and brucellosis. APHIS and FSIS have several Memorandums of Understanding in place that detail the various responsibilities and roles of the two agencies in these programs.
- We also collaborate with the Centers for Disease Control (CDC) in the implementation of the Select Agent Regulations. These regulations require that any facility that possesses select agents (viruses, bacteria, and prions) that have been determined to be high consequence agents if maliciously used, must register with either APHIS or CDC.
- For APHIS to succeed, we partner with FSIS, FDA, CDC, as well as consumers, industry, producers, and local State agricultural departments. Without those partnerships we would be unable to fulfill our mission.

Ethics and Philosophy of Science: North America and Europe

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INTRODUCTION

In a discussion about attitudes toward animals and people, a colleague of mine in graduate school once said that she felt that each culture differed in what children were taught to value. She was born and lived in Britain during her youth, moved to Japan and lived there until her teenage years, and then moved to the USA where she completed her high school and undergraduate education. She said that probably the British considered mistreatment of an animal to be the worst possible act that a child could commit, the Japanese stressed the importance of cultural mores and respect for other persons, but in the U.S.A. the greatest emphasis was placed on teaching children to respect another person's property.

Of course one should not stereotype all Americans, or any other group for that matter, as being all of one belief and this was not the intention of my graduate student colleague. Rather, she was noting that there are cultural differences in what is emphasized and these differences are taught or otherwise passed on to children. The messages children take from this process may not be official policy of the country's government or otherwise codified, but nevertheless, a culture passes on certain views and beliefs across each generation including those having to do with animal welfare. And on the basis of laws, research emphasis, etc., I would contend that British people do in fact place a very high level of importance on animal welfare compared to people of many other countries including the U.S.A.

Additionally, it is generally recognized that Northern Europeans in total place considerable emphasis on animal welfare as evidenced by the development and adoption of the European Union animal welfare legislation and codes of practice. And no doubt this result is at least in part due to cultural values and differences including what parents and early educators pass on to children. But given that Northern Europeans, especially the British, largely shared a common culture with early Americans, how did it develop that today we hold different views on the importance of animal welfare? And why is it that American and Northern European scientists in turn have differences in how they view animal welfare? In the following discussion, I will attempt to give some insight into how one might answer these two questions.

EVOLUTIONARY BIOLOGY AS THE EUROPEAN FOUNDATION FOR ANIMAL WELFARE

Seven or eight years ago, I gave a seminar at the school of veterinary medicine in Copenhagen, and a question presented to me afterward made a major impression on me regarding how American Science and European Science may differ in terms of animal welfare. I was asked, "When are you Americans going to start being scientific in dealing with animal welfare?" American scientists tend to view Europeans as being too emotional and thus not scientific in dealing with animal welfare. Thus, it seemed somewhat ironic at the time that I was asked this question.

In fact my answer was something to the effect, "If I used the prevailing American view, I could turn this question back to you and ask when are you Europeans going to stop being so

emotional and subjective in your dealing with animal welfare and start being more scientific - like we Americans?@

But in answering this question, I also went on to add that I did not think that people of any group should not have their diets dictated by what a select number of researchers consider to be good science.@ And as a parallel I gave the example that if children or prisoners were used to manufacture shirts through forced labor practices, then one should not be limited to purchasing only these shirts simply because they were cheaper and their production had resulted in the other manufacturers being forced into bankruptcy. Granted children and prisoners are not simply animals, and I was not attempting to argue a direct equivalency between the suffering of animals and children; rather I was trying to make the point that one should have the right to choose not to purchase food or clothing that are produced as a result of suffering caused to a sentient creature, either human or non-human. Additionally, there is no scientific basis for contending that prisoners and children should not be used as laborers. It is on the basis of ethics not science that most persons consider it wrong to exploit disenfranchised individuals as cheap laborers. Similarly, if some persons consider that certain food animal production practices (e.g., close confinement, surgical alterations, etc.) are exploitive of and cruel to animals, then I would argue that a position based on science should not be used to eliminate the right of these persons to choose their diets, i.e., force individuals to accept food produced by animals subjected to practices that these persons consider to be less than humane. In short, I was suggesting that science is not the basis for what one chooses to consume, and that giving individuals choice should be endorsed by animal agriculture not thwarted. And I concluded with a statement that too many Americans, in my opinion were unwilling to accept that ethics should be the foundation on which decisions about animal treatment should be based. If one accepts the concept dating back to Socrates that the correct ethical thing to do was the one that had the best reasons for doing! Thus, using this approach then the correct ethical treatment of animals would also include the best evidence of science. However, given that Europeans and Americans differ in their view of science as it relates to how animals ought to be treated, this view is possibly not one that may easily be implemented in the form of a common policy.

Thus, in my answer to the question of why Americans are not being scientific in dealing with animal welfare or at least in the view of these Europeans or I started out talking about science and then made a transition into a discussion about ethics.

Since first asked this question, I have given a great deal more thought as to why Europeans and Americans academics generally differ in their view of animal welfare, especially as to each group contending that the other is not being scientific.@ In fact I believe Americans and Europeans for some time have tended to diverge in their views about animals to the point where we now basically have two different Philosophies of Science when it comes to animal welfare. The basis for this divergence I will contend largely dates back to Darwin's 1859 publication, *Origin of the Species*.@

Stated simply, Darwin presented the view that humans and the other animals did not originate as separate acts of creation. Rather, all life both past and present share one common ancestor, and the diversity of life on Earth as we know it emerged as a consequence of natural selection, i.e., the organisms possessing genes resulting in behavior and physiology most suited to living and reproducing in a given physical and social environment produce more copies of their genes by having more offspring. And this is stating nothing more than to say that the process of natural selection brought about species of animals that are behaviorally and physiologically adapted to

given environments. In Britain, because AOrigin@ so obviously clashed with the long standing view from Genesis that animals were created on one day and humans were created on another day, Darwin-s publication was greatly and hotly debated both within the academic world and also among members of the public at large. While this debate was occurring in Europe, there was participation by American academics, but the American public, at large, were preoccupied with the American Civil War and its aftermath including Reconstruction and expansion and settlement of the American West. As a consequence, the concepts introduced by Darwin were not assimilated into the views of Acommon Americans@ to the same extent during this time period as occurred among persons in Britain and many of the other Northern European countries. In fact one definition of science is that Ascience is common knowledge@ meaning that concepts, laws, or principles of science eventually become incorporated into the common knowledge of a group of people. As an example, at the time of Watson and Crick-s initial publication, the structure of DNA was understood by a limited number of researchers, but today a majority of the public has some concept of DNA being a double helix, etc. Back to the point I wish to make - evolutionary biology became Acommon knowledge@ to a greater extent among Northern Europeans than it did among Americans.

This lesser awareness and/or acceptance of evolutionary biology can then extend into much greater divergences between societies including differences in the views or understanding of concepts such as animal welfare. For example, Darwin contended that Athe minds of humans differ from the minds of other animals only in degree and not in kind.@ What Darwin meant was that humans share eons of evolutionary time in their development that is common to other animals, and as a consequence we differ from them only incrementally B not in any way that can be said to be completely unique to humans. This is especially so in terms of differences between humans and the primates and less so when talking about the broader category we have come to call mammals. But we humans share a large amount of common behavior, physiology, genetics, brain structure, etc. with mammals; otherwise, they would not be useful as models in research having to do with nutrition, disease, learning, behavior, etc. In fact in the classification of animals, humans are scientifically placed into the primate category along with a number of other species into the class of mammals B because we differ from them only in degree and not in kind. And as previously stated, a lack of accepting this concept as one from evolutionary biology can have a profound impact on how one views B or what ethical consideration one gives to B an animal. I will try to elaborate.

If one views an animal as being a product of its evolutionary history, one tends to take a view that what an animal does (behavior) and its experiences (feelings, etc.) in a natural setting should have importance in terms of deciding what animals of that species should experience during their lives when used for food production or otherwise. And I think that it is important to point out that nested within this previous sentence is a contention that, in fact, is a normative statement; specifically, it contains a value-based judgment regarding how animals OUGHT to be treated. And this normative statement starts with a specific view of Awhat an animal IS.@ Whereas, relative to animal welfare, Europeans have the view that each animal is largely the product of its evolutionary history, and this includes its behavior and not just its anatomy and physiology.

As a specific example, Europeans are more likely to view rooting behavior as an inherent part of what a pig IS. Thus, the argument becomes for them, ARooting behavior IS a part of the genome of a pig that came about through natural selection. Thus, pigs OUGHT to be provided the opportunity to perform rooting behavior.@ Specifically, Europeans tend to argue from a

Philosophy of Science, at least in terms of animal welfare, which holds that, AWhat IS implies what OUGHT to be.® And again this European science view of animal welfare developed primarily from their having come to view behavior as being an adaptive trait, i.e., a view that behavior is adaptive in the same manner as is an animal-s anatomy or physiology.

INFLUENCE OF ETHOLOGY OF EUROPE VERSUS BEHAVIORISM OF AMERICA

The discipline of Ethology in its modern form developed in Europe and was specifically devoted to the Astudy of behavior as an adaptive trait.® Ethology focused on the investigation of animals in their natural setting influenced by Konrad Lorenz and Niko Tinbergen who used the concept of a AFixed Action Pattern® (FAP) in their explanation of what might be called instinct among lay persons (Figure 1). These researchers viewed the FAP as any behavior that was common to all members of a species and required no (or little) learning for its expression. Additionally, a FAP could be expressed in a Avacuum,® meaning that once the level of motivation reached a threshold level in an animal, the behavior would be performed by the animal independent of any apparent stimuli appropriate to the behavior. While these early Ethologists did little research with food animals, today we know that nest building-like behavior is performed by sows and gilts in gestation stalls during the time period immediately preceding farrowing. The sows chomp on the bars and this is not a stereotypy for it occurs only just prior to farrowing. Sows not only chop on the bars, they make head movements as if they are building a nest, even though no nest-building material is available to the sows. Thus, the early ethologists would have called this a FAP B because it is a behavior that is adaptive and is fixed to the genome of pigs, even those that have been under the influence of domestication for 8 thousand or more years. The FAP term is no longer widely used by scientists, ethologists or otherwise, but the general concept is still very much in existence. Relative to animal welfare the concept was introduced by Thrope, a member of the 1965 Brambell Committee which is the basis for British policy on animal welfare. The Brambell Report included the concept that animals have Abehavioral needs® which was probably a position taken by Thrope and is essentially the FAP concept with a different title.

The discipline of ethology was largely rejected by American animal behavior researchers B at least in the initial years. Instead, the discipline of Behaviorism prevailed in its influence on views about animals through at least the 1970-s and continues to have influence today. Behaviorism was a contention that one could not measure what was inside a black box (an animal or human-s mind), one could only measure the behavior that came from the black box; hence the term behaviorism. John B. Watson, the founder of behaviorism, contended that, AConsciousness was neither a useful nor usable concept.® And in fact the discipline of behaviorism followed the laws of parsimony (using the simplest explanation for a given phenomenon) to the greatest extent possible largely contending that concepts such as animal feelings, consciousness, etc. were not present in animals B or at least could not be studied B on the basis of absence of direct scientific proof.

The early ethologists also tended to dismiss or not directly address concepts that were of a subjective nature. However, in more recent years the applied ethologists, who are largely Europeans with the majority being educated in Britain, have tended to more directly address and incorporate the use of subjective states of animals in what Dawkins first called AAnimal Welfare Science.® Specifically, Marian Stamp Dawkins argued that we humans use the behavior of other humans to determine the happiness, well being, etc. of that individual. She additionally argued that it was not invalid for scientists to use these criteria in assessing the welfare of animals. Ian Duncan took her idea to the point of stating that Aanimal welfare is all about what

the animal feels, and this idea is obviously one that is in direct conflict of the American view of behaviorism. Behaviorism had a great influence on persons who took psychology as their only behavior-related course through at least the 1970-s in which was stressed a very rigid application of Occam-s Razor, the principle that states that the scientific explanation of any phenomenon should make as few assumptions as possible. Behaviorism dismissed animals as having subjective feelings, etc. because it is possible to explain complex behavior without a contention that the animal is actually sentient. However, it should also be noted that Europeans may use Occam-s Razor to refute this view and contend that the similarity between humans and other animals is the simplest explanation for what animals experience, etc.

The European Philosophy of Science relative to animal welfare tends to be one in which questions regarding *what ought to be* are incorporated into their science in direct relation to *what is* from the basis of the animal-s evolutionary past. Additionally, the ethologists (through Thrope and others) and more recently, the applied ethologists have played major roles in the development and writing the European codes of practice and policies. Whereas, American scientists tend to attempt to evade dealing with questions that are posed as ethically-based and contend that *science alone* should be the basis for dealing with animal welfare. Additionally, in the U.S.A. animal welfare policy on the care and use of research animals was drafted primarily by veterinarians and published in the form of the so-called NIH (National Institutes of Health) Guide. The first edition was published through the NIH, and the second edition commonly called the ILAR (Institute for Laboratory Animal Research) Guide which was published through the National Research Council. The NIH Guide was influential in formulating policy and ideas about animal welfare in general, and additionally greatly influenced the development of the first edition of the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching. Because the NIH Guide was written by veterinarians, it gave considerable emphasis to issues such as cleanliness, sanitation, antiseptic surgery procedures, etc. and these concepts have tended to carry over into American views about appropriate animal welfare in general. And the increase in emphasis on animal welfare has arguably resulted in less *not more* behaviour-related publications in the U.S.A. I make this contention on the basis that one time there were a number of applied behavior researchers active in the Animal Behavior Society. Additionally, a number of text books were once published on behavior of domestic, e.g. the series edited by Hafez. As a consequence of the emphasis today being placed on welfare, behaviour has tended to take a back seat to stress physiology. In the U.S.A. the competitive funds for *animal well-being* has primarily been grouped in with *animal diseases*. Thus, persons with veterinary medicine background tend to have the predominant role in the selection of research proposals to be funded. Whereas, Europeans tend to have given much less emphasis to the role of veterinary medicine-type criteria to animal welfare decisions, and instead tend to emphasize the importance of features such as animals having access to outdoor or natural living conditions. Thus, I have witnessed research conditions in Europe that would not be considered to be acceptable to Americans because the pigs, for example, were living in conditions that would be considered to be not sanitary. Whereas, Europeans would tend to view the near sterile American housing conditions to not be acceptable because the animals were too closely confined and not living in conditions considered to be *natural*.

SUMMARY AND CONCLUSION

American and Northern European Scientists tend to have two different views regarding science as it relates to animal welfare. In short one could say that they have two different Philosophies of Science in relation to animal welfare. Europeans tend to incorporate *what ought to be* as

being part of their Animal Welfare Science. Americans tend to hold a more rigid view of science in dealing with animal welfare questions and generally apply the rules of parsimony contending that subjective states should not be a part of scientific positions on animal welfare. These differences, I have argued, result largely from Americans having generally less emphasis and historically less educational tradition in the application of evolutionary biology to questions about animal welfare. I should note that writing about evolution, differences between Europeans and Americans etc. using such a contracted format has the potential for the reader misunderstanding my intended purpose. To be clear, I do not intend to infer that Americans are correct in their views and Europeans are wrong. Indeed, I personally believe that Americans must move to increase their understanding of evolutionary biology relative to animal behavior and animal welfare or else I fear we will be left behind the rest of the world in dealing with animal welfare issues. However, I also do not agree with the largely European contention posed within the so-called discipline of Animal Welfare Science that what ought to be dealt with as a science. Specifically, I would argue that it sets a bad precedent for a discipline of science to openly incorporate questions about what ought to be as ones that are to be addressed through science. Rather, I think scientists should openly acknowledge that questions about what ought to be are specifically ones of ethics and then acknowledge that it is appropriate for scientists to deal with ethical questions. But when dealing with ethical questions, I would additionally argue that scientists should do so by interfacing with ethicists and accordingly learn the tools-of-the-trade as used by them. Finally, I think that there is a need for greater dialogue between Americans and Europeans scientists on the topic of animal welfare and ethics to ensure that the current gap does not become even wider as a consequence of our holding two different Philosophies of Science relative to animal welfare.

Figure 1. A Comparison of Ethology and Behaviorism in the Study of Animal Behavior

	Ethology	<i>versus</i>	Behaviorism
Origin	Europe, c. 1930		N. America, C. 1920
Discipline	Zoology		Psychology
Subjects	Birds, fish, insects		White rats, pigeons
Setting	Natural Habitat		Laboratory
Focus	“Instinct”, the study of the evolution of behavior		“Learning”, the development of behavior
Methodology	Observation and description, field experimentation		Lab work, control of variables, statistical analysis
Noted workers	K. Lorenz, N. Tinbergen, K. von Frisch		J.B. Watson, B.F. Skinner

(After Dewsbury, 1978; Comparative Animal Behavior; McGraw Hill, NY)

How Can Food Animal Production Systems be Improved Without Being a Threat to Animal Production and Food Security?

Dennis Treacy
Smithfield Foods
Smithfield, VA

Paper not provided. See Appendix C for the power point slides.

Support for Food Animal Production: What Should the Role of Land Grant Universities Be?

Maynard Hogberg
Iowa State University
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INTRODUCTION

The Morrill Act of 1862 established the land grant system to provide educational opportunities for the sons and daughters of working class people and to provide knowledge to benefit individuals, communities and states. This educational system was the first to provide hope and opportunity for those who previously had been excluded from higher education and also set in place a system whose mission was to improve the efficiency and quality of food production. With the passing of the Hatch Act in 1887 and the Smith-Lever Act in 1914, which established the research and extension programs, respectively, the three part mission of teaching, research and extension, was in place. This system has propelled the food system in this country to be the most efficient, highest degree of safety and lowest cost in the world today. The strength of the system has been how the teaching, research and extension were intertwined within the universities and autonomous from political agendas. Public funding from a state and federal partnership provided the opportunity for scientists to shift the focus of their research and extension programs in areas of importance in providing an efficient and safe food supply. Providing unbiased, objective facts and information from a total food production system perspective, even at times when this may be contrary to political agendas of government, commodity or other organizations, has been a valued hallmark of the system. Research agendas have been driven by the mission to work in areas of importance of economic, social and environment rather than addressing questions of solely academic interest. A vibrant extension system that transferred the knowledge to the production sector allowed for a quick transfer of technology and knowledge as well as providing for quick feedback on results on the application of the knowledge. It has been at this level the true systems approach of bringing the disciplines together has existed. To solve the problems of societies often required an inter-disciplinary approach in order to find meaningful and useful answers.

Bonnen (1986) discussed the importance of a land grant system to maintain an inter-disciplinary research program that ranges from fundamental disciplinary research to applied, problem solving research and application. In Figure 1, Bonnen shows the flow of information from fundamental disciplinary research to subject matter to problem solving knowledge and finally to use of the knowledge. It is interesting to note that the flow of information is bi-directional, and an important feedback to the fundamental research stems from experiences in using the knowledge. Adaptations of Bonnen's model to animal agriculture is shown in Figure 2. Further extrapolation of this model is shown in Figure 3. This diagram further shows how important it is to go from disciplinary research to interdisciplinary application in our livestock production systems. Bonnen's model for the creation, development and utilization of knowledge is still needed today if land grant universities are to be relevant and engaged in building a food system that meets the need of a growing population worldwide.

FUTURE

The land grant university of today is decidedly different from that of the past. Funding for food animal production research and extension programs through USDA-CSREES and through state government has declined in terms of nominal dollars (National Research Council, 2003). Research and extension programs are driven by grants and priorities of granting agencies and institutions rather than from traditional public funding. State budgets have shifted from agriculture to non-agriculture priorities. In many universities, faculty numbers have declined, especially those with extension appointments. Fields *et al.* (2007), concluded that a failure to invest in the intellectual assets of the beef industry will contribute to reduced food security for U.S. consumers, heightened conversion of agricultural land to development, and fewer opportunities for people to work in the beef industry. Programs that normally focused on improving production and production efficiency have given way to programs that focus on food safety, environmental quality, animal welfare and alternative systems of production. While important, these fields do little to expand the sector, its competitiveness and opportunities.

Some aspects of the land grant university mission to support food animal production have not changed. There is still the need for the research programs to be relevant to the needs of food animal production. These programs need to be objective and need to be able to ask the difficult questions, regardless who's turf may be stepped upon. Participants in the food animal industries require unbiased, inter-disciplinary information that is relatively easy to access and that helps people make better choices. Participants include producers, processors and consumers but also policymakers in government and industry.

So how is this going to happen given the current trends within our land grant universities? Here are a few of my thoughts.

- There is a need to develop more regional and national centers that coordinate research and extension programs and bring together top scientists in land grant universities to find solutions to issues. These "Centers of Excellence" can be a model for directing research programs and transferring the results to the industry.
- Teaching programs in areas that can not sustain enrollments at each university need to look at developing regional programs that educate and train the future work force for the industry. The Midwest Poultry Consortium is an excellent example of how industry and universities have partnered in a program of excellence.
- Research and extension programs need to rebuild relationships with stakeholders and involve stakeholders in setting priorities.
- Funding for research and extension programs needs to come from a combination of federal, state and industry funds through a very transparent process.
- Universities need to utilize their disciplinary expertise to address issues of concern. This will require an inter-disciplinary approach.
- Land Grant Universities need to strive to maintain objectivity and provide unbiased and complete facts and information. There is a compelling need for complete facts of peer reviewed data to assess issues in a meaningful way.

- Research must maintain a balance of basic and mission-based research to lead agriculture forward while addressing current and emerging needs.
- Land Grant Universities must be engaged with stakeholders to understand issues that arise and provide timely research-based response. This relationship must remain transparent to instill confidence of objectivity.
- Research and extension programs must deal with a wide range of production systems objectively. Ranges in size of operation and alternative production systems all have specific needs for research and factual information. We must work to make sure that funding is available to be able to address these issues appropriately.

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Future of Global Standards for Animal Production

Michael David
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Animal Welfare was identified as a priority in the 2001-2005 OIE (World Organization for Animal Health) Strategic Plan. Member Countries recognized that the OIE, as the international reference body for animal health and zoonoses, was the organization best placed to provide direction and guidance on animal welfare. Although animal welfare is not addressed in the World Trade Organization's (WTO), Sanitary and Phytosanitary (SPS) Agreement, Member Countries agreed that the OIE should develop recommendations that would serve as a framework should they be needed for international negotiations in the trade of animals.

Since that time the OIE has developed a mission statement on animal welfare, established a permanent Working Group on Animal Welfare, and convened several ad hoc groups to address various animal welfare issues. The OIE's mission includes: To provide international leadership in animal welfare through the development of science-based standards and guidelines, the provision of expert advice, and the promotion of relevant education and research.®

The OIE has recognized that animal welfare is a complex and multi-factorial issue with important scientific, ethical, economic, cultural and political implications. As such, the OIE is acutely aware that any recommendations it proposes need to be grounded on sound science and practical experiences. Their commitment is to develop outcome-based rather than prescriptive guidelines. Performance-based guidelines provide the flexibility which enables care givers to consider the needs of individual animals and particular situations.

The OIE is now focusing on developing housing and production standards for livestock and poultry. The OIE Working Group on Animal Welfare has drafted a discussion paper which attempts to frame the direction for these new standards. This discussion paper, which was made available to Member Countries in April of 2007, identifies the complexities of developing standards that can be globally applied and proposes a road map for how these standards might be developed.

As new guidelines are developed, all 169 Member Countries will have several opportunities to review and submit comments on any proposed draft guidelines.

For 2008, the OIE is sponsoring a second Global Conference in Animal Welfare to be held in Cairo, Egypt. The conference will focus on getting Member Countries to implement the OIE guidelines on animal welfare. The acceptance and implementation of guidelines in international trade will probably occur slowly. Preferential consumer demands and demonstrable animal production gains will tend to accelerate the incremental application of animal welfare practices worldwide.

Panel: Outsourcing Food Animal Production: Projections for Animal Welfare

Marie Wheatley
American Humane Association
Englewood, CO

American Humane Association is the oldest humane organization in the United States, dedicated to protecting the welfare of both children and animals. Founded in 1877, the organization began with the need to address the inhumane treatment of workhorses. In 1879, American Humane began inspecting stockyards, rail cars and slaughterhouses in an effort to improve the welfare of farm animals.

Over 13 decades, American Humane has evolved and grown to encompass an array of services and programs that protect and enhance the well being of those without voices B children and animals. Through education, advocacy and motivation, we encourage humane behavior. Our headquarters are in Denver, Colorado, with regional offices in Washington, DC, and in Los Angeles.

Among our programs are ANo Animals Were Harmed® that monitors film and TV productions for the welfare of animals in entertainment; Red Star Animal Emergency Services that originated to protect horses during World War I; The Link, that raises awareness of the connection between animal abuse and other forms of violence and American Humane Certified® that audits and verifies farm animal welfare standards.

American Humane Certified is the first and original certification program to ensure the humane treatment of farm animals. It provides independent verification that the care and handling of farm animals by a certified producer meet the animal welfare standards of American Humane. Those standards are based on guidelines established by the American Humane Certified Scientific Committee.

Throughout our history, American Humane has held balanced, reasonable and moderate policies in support of animal welfare. We believe that people have the right to choose what they eat. Our mission is to ensure that animals raised for food are treated humanely; that producers who meet these animal welfare standards are recognized by the American Humane Certified label, and that consumers are made aware of the products that are certified through promotion of the label.

American Humane is agriculture friendly, believing that programs must be economically viable and achievable for the producer, if animal welfare certification is to be successful. It must be good for business and people, as well as animals. We believe in forming positive partnerships with agricultural alliances, trade organizations and producers to share knowledge and technology. Through these partnerships will come best practices for the welfare of farm animals as well as profitable businesses.

American Humane believes that the growth of animal welfare certification will come as partners with agriculture, not as adversaries. We strongly advocate motivation, rather than intimidation. We believe it should be a win-win situation.

As the number of American Humane Certified producers has increased, so too has consumer awareness and demand for humanely raised food. Our research shows that consumers are

concerned not only about how and where the food they buy is grown but how farm animals have been treated. The humane treatment of farm animals is a fast growing part of the social, ethical and environmental purchase equation among socially aware consumers.

While American Humane Certified is a value added proposition for producers, it is becoming a value added quotient in buyer consideration. Again, our research shows that consumers expect and are willing to pay more for humane certified labeled food.

The outsourcing of food animal production by major producers appears to be driven by the economics of producing less expensively off shore and by what many producers deem to be excessive regulations and legislation, perceived to be the results of lobbying by radical animal rights activists. In our view, any short term economic gains that outsourcing might produce could be overshadowed, in the long term, by the impact on farm animal welfare and negative consumer reaction. No longer is promotion of the concern for the welfare of farm animals the exclusive purview of activists. It is a major concern with socially aware consumers who vote with their purchasing power.

While some countries have demonstrated heightened concern for farm animal welfare, in some cases exceeding the US, we are very certain that many more countries do not share our social and ethical concerns for the welfare of animals. There would be no way to observe, nor control, animal raising and handling processes in other countries. While health and safety issues could be monitored, the welfare of millions of animals used for food would be out of sight and most likely, out of control.

American Humane holds moderate and reasonable views on food choices. We believe that people have a right to choose how and what they will eat. Eliminating food choices is not our agenda. Our mission is to ensure the welfare of farm animals, realizing that it has to be economically viable and achievable for producers, if we are to accomplish our mission. We believe in educating and motivating producers and businesses, as well as consumers, about the economic and social advantages of US production of food animals, relative to health, safety, and security of food, as well as the welfare of animals.

American Humane is open to dialogue and partnerships with food producers and businesses to discuss how the welfare of farm animals can contribute to the success of their operations. We look to working as partners, rather than adversaries. We know that many handling and processing practices are long established and there are substantial costs to retrofit operations. We know that changes cannot be made immediately. We know that we won't always agree on best practices for animal welfare. We also know that the welfare of farm animals is not just the passing passion of a few wild eyed radical people in activist organizations. It is a rapidly growing concern in the minds of socially conscious people who will decide to buy, or not buy, your product, based on where and how you raised and handled the animals.

Certification of the humane treatment of farm animals is a relatively new concept in the US. American Humane created the first program, seven years ago. Awareness of certification labels is growing as consumers and media become more aware of farm animal cruelty. Many consumers are demonstrating their disdain for businesses that practice or condone cruelty. American Humane Certified is committed to ensuring that all animals used for food are treated humanely and that certification of that humane treatment is a vital part of the purchase decision of consumers in food choices.

Panel: Outsourcing Food Animal Production: Projections for Animal Welfare

Mildred Haley
USDA, Economic Research Service
Washington, DC

Paper not provided. See Appendix C for the power point slides.

**Study Update: National Commission on Industrial Farm Animal
Production, Johns Hopkins School of Public Health**

Amira Roess

National Commission on Industrial Farm Animal Production in the United States
Washington, DC

Paper not provided.

How Will Biotechnology Impact Agricultural Animal Welfare?

Barbara P. Glenn, Ph. D.
Biotechnology Industry Organization
Washington, DC

INTRODUCTION

Biotechnology is the set of techniques by which living creatures are altered for the benefit of humans and other animals. Animal biotechnology has a long history, dating back 10,000 years, beginning with humankind's domestication of animals. Modern technologies have been adopted since the 1950-s, including artificial insemination, embryo transfer, and *in vitro* fertilization. Beginning in the late 1980-s, the potential impact of molecular biotechnology approaches on animal welfare, has raised potential concern, as well as generated enthusiastic interest, among consumers, livestock producers, public and private research institutions, and government agencies (National Research Council [NRC], 2002). The animal biotechnology industry recognizes that animal welfare is of paramount importance and therefore, has been and will continue to ensure that animal welfare is unsurpassed.

ANIMAL WELL BEING: A TOP PRIORITY

The top priority for the animal biotechnology industry is animal well being, through our adherence to good stewardship principles that promote animal care. Benefits will only be realized from using animals that are healthy and receiving appropriate humane care. BIO members provide industry leadership for the ethical application of animal biotechnology to improve animal and human well-being. The industry seeks to improve the global food supply and quality through the application of animal genomics, cloning, and genetic engineering, and thereby provide solutions to issues important to humankind's health and a sustainable environment.

BIOTECHNOLOGY-DERIVED ANIMALS: IMPROVING ANIMAL HEALTH AND WELL-BEING

Biotechnology is currently and will continue to improve animal health and well being in the future, as new research and development drives toward commercialization of products. Investments in genomic technology, from gene discovery to sequenced genomes, have animal agriculture poised at the threshold of the genomic revolution. Genome based technologies are and will continue to improve animal food products. Additionally, animal genomics will allow improvement of genetic traits that have been difficult to measure with quantitative genetic approaches such as disease resistance, animal well-being, feed efficiency and product quality. Call will lead to enhanced functionality and well-being of animals (U. S. Department of Agriculture [USDA], 2007).

Livestock cloning offers rapid dissemination of genetics from superior animals, with the overall impact to improve herd health and well being. Cloning superior founder animals and then using them in breeding programs, has the potential to provide access to proven genetics across the population in a rapid manner, which provides healthier animals and consistent animal food products. Adoption of cloning for food production awaits US Food and Drug Administration's

(FDA) final decision supporting their recent affirmation of safety of cloning, as published in the draft risk assessment.

Genetically engineered animals are animals in which there has been a deliberate modification of the genome using modern molecular genetics techniques. Industry, academia and government are involved in research and development of genetically engineered animals, which have the potential to improve animal well being by enhancing disease resistance and production efficiency. In the world, there is currently only one approved product from a genetically engineered animal. Human antithrombin, approved by the European Commission in 2006 (<http://www.gtc-bio.com/>), is an anti-blood clotting factor with anti-inflammatory properties that is normally present in human plasma. The protein may be used for treatment of hereditary antithrombin deficiency, or patients at risk for developing deep vein thrombosis or thromboembolism while undergoing surgical procedures or childbirth. The human antithrombin is a protein that is produced in the milk of genetically engineered goats. Other examples of genetic engineering include mastitis resistance in cattle, resistance to development of bovine spongiform encephalopathy, resistance to avian influenza, improving digestion in nursing pigs, improving digestion of dietary phosphorus in growing swine, and increasing rate of growth in salmon. The use of the tools of genetic engineering has the potential to remarkably improve, not only animal health and well being, but also human health.

Animal health has also advanced as a result of research using biotechnology in the development of animal health products. There are over one hundred USDA-approved biotechnology-derived veterinary biologics and vaccines that improve the health of livestock, poultry and companion animals. Biotech veterinary products to treat heartworm, arthritis, parasites, allergies and heart disease, as well as vaccines for rabies and feline HIV, are used daily by veterinarians.

PRINCIPLES OF HUMANE CARE AND USE OF ANIMALS IN RESEARCH

Research institutions, companies and producer groups engaged in the growing field of animal biotechnology take animal well-being very seriously. BIO's Statement of Ethical Principles for the Care and Use of Animals in Biotechnology Research (<http://bio.org/bioethics/background/animals.asp>) notes that the ability to conduct humane and responsible animal-based research must be preserved to help conquer disease, alleviate suffering, and improve quality of life. BIO believes that such use is a privilege, imposing a responsibility to provide proper care and humane treatment in accordance with several principles.

Notwithstanding the benefits of biotechnology to animal health and well being, there are challenges. BIO is committed to the minimization of discomfort, distress, and pain consistent with sound scientific practices. Investigators and personnel shall be appropriately qualified for and experienced in conducting procedures on animals and in the husbandry and handling of the species being studied.

REGULATORY OVERVIEW

The humane care and use of animals in genomics, cloning and genetic engineering research and application is guided by rigorous regulatory review and, in some instances, third party review.

Genetic engineering. The Department of Health and Human Services, Public Health Service (PHS) and the USDA are responsible for regulating the use of animals in biomedical research.

The USDA regulates animal care under the auspices of the Animal Welfare Act (AWA). Both departments refer to the guidelines established in the Institute for Laboratory Animal Research (ILAR) Guide (National Research Council, 1996). In nearly all instances, the AWA policies are completely consistent with the PHS policy. The USDA's Animal and Plant Health Inspection Service also formally adopted the use of the ILAR Guide and the Guide for Care and Use of Agricultural Animals in Agricultural Research and Teaching (Ag Guide) developed by the Federation of Animal Science Societies (1999). Therefore, genetically engineered agricultural animals used for biomedical research are subject to regulatory review.

Voluntary standards for care of agricultural animals used in food and fiber (agricultural) research have been in place for nearly twenty years, because the AWA excludes these animals. Notably, all Land Grant Institutions and all practicing private industry entities that conduct research with agricultural animals have adopted the Ag Guide, and require the use of Institutional Animal Care and Use Committees (IACUC) protocols. The IACUC is devoted to the principle of carrying out meaningful scientific research through the use of animals in accordance with humane standards. Furthermore, APHIS regulates research facilities used for certain vertebrate animals, including vertebrate animals that are genetically engineered.

In addition, for universities and private organizations receiving funding from the National Institutes of Health (NIH), compliance with the NIH Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines) is mandatory. Therefore, even privately funded projects employing recombinant DNA must adhere to the NIH Guidelines if they are being carried out at, or funded by, an organization that has any NIH contracts, grants, or other support for this kind of research. Adherence to the NIH Guidelines is mandatory and important because they stipulate biosafety and containment measures for recombinant DNA research.

Cloning. It is not expected that livestock clones and their progeny will require unique regulatory review. The FDA has been evaluating the safety of livestock cloning to provide regulatory guidance. The agency recently published a rigorous draft risk assessment on the safety of livestock cloning, including health and well being of the animals, as well as safety for consumers. The FDA concluded that there are no unique health risks to animal clones compared to their counterparts. Further more they concluded that foods from livestock clones and their offspring are as safe to eat as foods from animals produced using conventional breeding methods or other assisted reproductive technologies. Therefore, the FDA noted that there is no science-based reason to recommend any additional safeguards or any additional measures related to the use of products from cattle, swine, or goat clones as human food. It is likely that the FDA final risk assessment will affirm these findings, and therefore they will not recommend unique regulations for animal clones nor their progeny. The final decision will likely lift a voluntary withholding of these animals from the food supply, which will initiate use of cloning for food production.

INTERNAL AND THIRD PARTY REVIEW

The vast majority of laboratories conducting animal research are accredited by the Association for Assessment and Accreditation Laboratory Animal Care International (AAALAC). AAALAC is an internationally recognized organization that accredits both biomedical and agricultural research institutions and private firms. In addition, all commodity groups for agricultural animals have developed science-based programs for animal care and use on the farm which are endorsed by the organization and adopted by their members.

The Federation of Animal Science Societies is revising the Ag Guide which will likely include any appropriate recommendations on science-based animal care provisions regarding agricultural animal clones and genetically engineered animals. The International Embryo Transfer Society (IETS) is developing a set of standards for care of neonatal agricultural animal clones which will provide guidelines for the use of somatic cell nuclear transfer. IETS standards for embryo transfer, another assisted reproductive technology, have already been adopted and recognized by the OIE, (the World Animal Health Organization), Food and Agriculture Organization, World Health Organization and the World Trade Organization. The IETS is also developing a comprehensive international database on the health of agricultural animal clones and the composition of their food products which will be available internationally.

CONCLUSION

Animal biotechnology is currently and will continue to provide benefits to animals and consumers through improved animal welfare that assures the safety of final products. Scientific research will continue to identify improvements in animal welfare. Livestock producers and consumers have the opportunity with biotechnology-derived animals to benefit from improved agricultural animal health and productivity, enhanced animal food products, conservation of animals and improved human health. Animal well being and care is our top priority. In addition to meeting regulatory requirements, the industry will work proactively to assure good stewardship to animal care.

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<http://www.csrees.usda.gov/newsroom/news/2007news/blueprint.html>

BIO represents more than 1,100 biotechnology companies, academic institutions, state biotechnology centers and related organizations across the United States and 31 other nations. BIO members are involved in the research and development of healthcare, agricultural, industrial and environmental biotechnology products. The animal biotechnology industry is an important and growing sector of the biotechnology industry, which is developing new products from genetically engineered animals. Agricultural animals improved through biotechnology will advance human health, enhance animal health, improve the quality of meat, milk and eggs, and conserve species and the environment. <http://bio.org/foodag/>, www.clonesafety.org

Appendix A

Program and Speaker Contact Information

- Morning Moderator** Richard Reynnells, National Program Leader, Animal Production Systems
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Email: rreynnells@csrees.usda.gov
- 8:30 - 8:35 **Welcome**
Richard Reynnells
- 8:35 - 8:45 **Introductory Comments**
Charles Conner, Deputy Secretary
US Department of Agriculture
Washington, DC 20250
- 8:45 - 9:15 **What Should/Could Food Animal Production Look Like in 2020?**
Steven Blank
(Author of *The End of Agriculture in the American Portfolio*)
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- 9:15 - 10:00 **Panel: What Should Animal Agriculture Look Like?**
- 9:15 - 9:30 Wayne Pacelle
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- 9:30 - 9:45 Steve Kopperud
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- 9:45 - 10:00 Discussion

- 10:00 - 10:20 **What Should the Role of APHIS Be In Food Animal Production?**
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- 10:20 - 10:40 BREAK
- 10:40 - 11:00 **Ethics and Philosophy of Science: North America and Europe**
 Ray Stricklin
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 University of Maryland
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- 11:00 - 11:20 **How Can the Food Animal Production Systems be Improved Without Being a Threat to Animal Production and Food Security?**
 Dennis Treacy
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- 11:20 - 11:40 **Support for Food Animal Production: What Should the Role of Land Grant Universities Be?**
 Maynard Hogberg
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 Iowa State University
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- 11:40 - 12:15 **General Discussion**, Led by Moderator
- 12:15 - 1:30 LUNCH (on your own)**
- Afternoon:**
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 Agri-business Consultant
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- 1:30 - 2:00 **Future of Global Standards for Animal Production**
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- 2:00 - 2:40 **Panel: Outsourcing Food Animal Production: Projections for Animal Welfare**
- 2:00 - 2:20 Marie Wheatley
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- 2:20 - 2:40 Mildred Haley
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- 2:40 - 3:00 **Study Update: National Commission on Industrial Farm Animal Production, Johns Hopkins School of Public Health**
Amira Roess
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- 3:00 - 3:20 BREAK
- 3:20 - 3:40 **How Will Biotechnology Impact Animal Welfare?**
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- 3:40 - 4:00 General Discussion, Led by Moderator

Appendix B

2007 List of Co-Coordiators

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Appendix C

Power Point Presentations

[What Should/Could Food Animal Production Look Like in 2020?](#) (PDF|33 KB)

Steven Blank, University of California, Davis

[Panel: What Should Animal Agriculture Look Like?](#) (PDF|898 KB)

Wayne Pacelle, Humane Society of the United States

[How Can Food Animal Production Systems Be Improved Without Being a Threat to Animal Production and Food Security?](#) (PDF|321 KB)

Dennis Treacy, Smithfield Foods, Inc.

[Support for Food Animal Production: What Should the Role of Land Grant Universities Be?](#) (PDF|58 KB)

Maynard Hogberg, Iowa State University

[Future of Global Standards for Animal Production](#) (PDF|398 KB)

Michael David, USDA/APHIS

[Panel: Outsourcing Food Animal Production: Projections for Animal Welfare](#) (PDF|52 KB)

Marie Wheatley, American Humane

[Panel: Outsourcing Food Animal Production: Projections for Animal Welfare](#) (PDF|35 KB)

Mildred Haley, USDA/ERS

[How Will Biotechnology Impact Animal Welfare?](#) (PDF|480 KB)

Barbara Glenn, Biotechnology Industry Organization