Acta Agraria Kaposváriensis (2001) Vol 5 No 1, 17-32
Kaposvári Egyetem, Állattudományi Kar, Kaposvár
University of Kaposvár, Faculty of Animal Science, Kaposvár

Societal and professional implications of industrialized farming of livestock and poultry

P.R. Cheeke
Department of Animal Sciences, Oregon State University, Corvallis, OR 97331 USA

ABSTRACT

The author gives an overview regarding the controversial issues in agriculture brought about by the industrialised farming of livestock and poultry, dealing specifically with the problems of: corporate control of animal agriculture, use of grains in animal agriculture, food safety and health issues, environmental effects, social effects and professional implications with special reference to pig and poultry production.
(Key-words: industrialisation, animal production, environment, controversies, societal implication)

ÖSSZEFOGLALÁS

Az iparszerű állattenyésztés hatásai, különös tekintettel társadalmi és foglalkoztatási szempontokra

Cheeke P.R.
Oregon Egyetem, Állattudományi Intézet, Corvallis, OR 97331 USA

A szerző áttekintést ad az iparszerű állattenyésztés ellentmondásos hatásairól, elsősorban az USA-ban legújabban bekövetkezett folyamatok elemzésével. Kiemelten tárgyalja a korporatív csoportok növekvő befolyását, az egészségügyi és élelmiszerbiztonsági kérdéseket, környezetvédelmi, szociális és a foglalkoztatáspolitikai szempontokat. Részletesen foglalkozik a globalizáció és az iparszerű sertés valamint baromfitermelés új tendenciáinak hatásaival a koncentrációs, ill. regionalizálódási folyamatokra, a munkaerőpiacra továbbá a szaktudományok fejlődésére.
(Kulcsszavak: iparszerüség állattenyésztés, környezetvédelem, ellentmondások, szociális hatások)

INTRODUCTION

Poultry production in the United States is now an industrial process. Poultry meat production is controlled by less than 10 vertically-integrated companies. The swine industry is also rapidly becoming industrialized. Critics refer to industrial animal production as "factory farming." There is increasingly a societal back-lash to what is perceived as factory farming. Major societal concerns are: (1) intensive animal production is inhumane and detrimental to animal welfare, (2) animal production is controlled by corporate interests rather than by family farmers, and is driven by profit motives rather than by ethical concerns for animal well-being, (3) intensive corporate animal production exploits workers, (4) modern animal production competes directly with grains used for

human consumption, (5) diets containing animal products are unhealthy, causing degenerative diseases such as heart disease and cancer, (6) animal products are produced using antibiotics, hormones and other chemicals, resulting in food safety concerns, and (7) intensive animal production is harmful to the environment. In general, animal and poultry scientists are supportive of intensive, high-tech animal production, and have been responsible for much of the research which has led to technological innovations in animal agriculture. One of the consequences of industrialization of animal production is that fewer animal and poultry scientists are needed. A result is shrinking memberships of professional organizations such as the American Society of Animal Science (ASAS) and the Poultry Science Association (PSA). To remain viable academic disciplines, new approaches are needed. Research is needed to modify animal production systems to address societal concerns. For example, it is anticipated that use of antibiotics as feed additives will be banned in many countries. Alternatives to antibiotics include phytochemicals such as yucca extract, obtained from the indigenous Mexican plant *Yucca schidigera*. Other opportunities for Animal Scientists will include greater emphasis on non-traditional animal species, such as equines, companion animals and zoo animals. An increasingly large number of Animal Science students are female. This presents various challenges, including greater recognition of the legitimacy of animal welfare concerns. Intensive systems of animal production, largely a result of technological advances pioneered by animal and poultry scientists, have led to numerous animal welfare, food safety and environmental problems. Biotechnology has introduced further ethical issues, for example with cloning of animals. Animal scientists should be in the lead in addressing these problems and concerns.

Human society is undergoing profound changes in all aspects of life. As the world's superpower, the United States (US) is at the forefront of both developing many of the technological advances, and in dealing with their consequences, many of which are unpredicted and/or negative. Hence, contentious issues in the US, while perhaps not of immediate relevance to other countries, probably soon will be. Agriculture is in the midst of many of these changes and issues. Plant science and crop production are wracked by controversies regarding biotechnology and genetic engineering, with introduction of so-called genetically modified organisms (GMO) at the leading edge. Animal agriculture is faced with many societal concerns, which will be the subject of this paper. Most of these concerns are of an ethical nature: are the new technologies in both crop and animal production unethical? What will the farm of the future look like? What ethical considerations are there for agricultural scientists, as they make their contributions towards the development of a new agriculture? I have considered some of these issues in a book, *Contemporary Issues in Animal Agriculture* (*Cheeke*, 1999a), and in an article in the Journal of Animal Science dealing with the future of Animal Science as a discipline (*Cheeke*, 1999b). The nature of animal agriculture in the US has changed markedly in the last 50 years, led by the industrialization of the poultry industry. Livestock and poultry are now mass-produced, often in very large confinement facilities. Critics refer to this as "factory farming" with the animals simply being "meat machines." Increasingly, animal agriculture in the US is being dominated by corporate entities rather than by individual farmers.

The societal concerns expressed in the US regarding intensive animal production include the following perceptions:

- Modern animal production is cruel and inhumane.
- Animal agriculture is controlled by large corporations whose primary motive is profit.
- Intensive animal production exploits workers.
- Intensive animal production using cereal grains increases world hunger.

- Modern animal agriculture produces unhealthy food.
- Animal production damages the environment.

These perceptions will be discussed.

CONTROVERSIAL ISSUES IN ANIMAL AGRICULTURE

"An excellent test of animal welfare is to discover whether their owner can display his animals with pride to any fair-minded observer….The special pleading required to suggest that the welfare of broiler fowls or laying hens is satisfactory, despite their appearance, is deeply unconvincing to almost any unbiased observer." (*Webster* (1994). Caged layers, high density broilers and tethered sows in stalls are examples of current practices that are increasingly viewed as inhumane and deleterious to animal welfare, with the abuse of animals simply as a means of increasing profit. Rather than defending these production systems, Animal Scientists might consider being responsive to societal concerns, and be at the forefront in developing more acceptable alternatives.

Rollin (1995) has pioneered the introduction of classical philosophical principles into the animal welfare debate. He advances the idea that a new social ethic for farm animal production is needed. The traditional social ethic, from the time of the early domestication of animals, is based on the symbiotic relationship between farmers and their livestock: we look after them and they look after us. Society in general accepted the relationship between farmers and their animals as being mutually rewarding and humane. The introduction of intensive production systems has shattered this confidence. The traditional social ethic was based primarily on preventing cruelty – the deliberate, sadistic, unnecessary infliction of pain, suffering and neglect. Animal Scientists have generally defined animal welfare in terms of economic efficiency and productivity, with the ingrained belief that animals are not productive unless well cared for. Society considers animal welfare in broader terms: animal welfare is defined in moral terms with consideration of effects of boredom, social deprivation, and psychological well-being. In essence, is the animal happy? Animal Scientists have tended to dismiss such concerns as being simply amusing. As one of my colleagues put it, "What's time to a pig?" *Rollin* (1995) strongly makes the case that these concerns are legitimate, and represent a "paradigm shift," in how animal agriculture is viewed by society.

Rollin (1995) has adapted (from Aristotle) the term "telos" to refer to the essential nature of animals. The telos is those characteristics which define an animal's species identity: the characteristics that make a chicken a chicken or a pig a pig. For example, ducks are waterfowl. Do producers of ducks have a moral obligation to give ducks the opportunity to swim? This issue has in fact surfaced in Europe (*Pingel*, 2000). *Rollin* (1995) suggests that society is extending to animals the moral framework it has developed for people – the expanding moral covenant. "Animal rights" does not imply human rights (free speech, religion, property rights) to animals. It does recognize the right of animals to exhibit their normal behavior or telos. Society is inexorably moving toward a new social ethic for animals, which does not preclude utilization of animals for food, but which demands that food animal production systems be humane and sensitive to the animals' basic needs and natures. This is a logical extension of the ever-expanding sphere of societal concern for sentient beings (*Cheeke*, 1999a).

In response to being kept in confinement in situations that do not permit normal behavior or expression of telos, many animals exhibit abnormal behavior such as tail biting, feather picking, cannibalism etc. Traditionally, Animal Scientists have termed these behaviors as vices, and have researched intrusive methods of preventing them such

as tail clipping, beak trimming, subdued lighting etc. These so-called vices are actually an animal response or coping mechanism to a sterile and unfulfilling environment. Increasingly, vocal segments of society are demanding that instead of blaming the animals for having vices, we should alter production systems to that they are more telos-friendly, and less likely to cause animals to attempt to cope with an unsuitable environment by engaging in abnormal and destructive behaviors.

Corporate Control of Animal Agriculture

The poultry industry in the US and many other countries is almost completely industrialized, with control in the hands of a few trans-national corporations (TNC) (*Table 1*).

Table 1

Largest U.S. broiler meat-producing companies, 1996
(Feedstuffs Reference Issue, 1997)

Company(1)	Average weekly production lbs (millions) of ready-to-cook meat(2)	% U.S. Market Share(3)
1. Tyson Foods	120	25.6
2. Gold Kist	45	9.6
3. Perdue Farms	42	9.0
4. ConAgra Poultry	30	6.4
5. Hudson Foods*	28	6.0
6. Pilgrim's Pride	28	6.0
7. Continental Grain	20	4.3
8. Cagle's	14	3.0
9. Seaboard Farms	13	2.8
10. Foster Farms	12	2.6
11. Townsends	12	2.6
12. Sanderson Farms	12	2.6
13. Fieldale Corp.	12	2.6

*Hudson Foods was taken over by Tyson Foods in Sept., 1997. *(A Hudson Foods ma már a Tyson Foods tulajdona.)*

1.táblázat: Az USA legnagyobb brojler előállításban érdekelt vállalatai, 1996

Vállalat(1), Konyhakész hús heti átlagtermelés (millió) £-ban(2), Az Egyesült Államok piaci részesedése, %(3)

Chickens have a number of biological characteristics which make them particularly suitable (or vulnerable) to industrial production. These have been summarized previously (*Cheeke*, 1999a,b). The usual pattern is vertical integration, whereby one company (the integrator) controls all aspects of production. Typically, the most risk-sensitive area, the actual production of the chickens (broilers) is contracted out to individual growers. A new level of integration, supply chain optimization, has been introduced, in which the feed ingredients are produced under contract to the integrators. The relative ease by which broilers can be produced industrially is an advantage in the new global economy. The

TNC can produce chickens wherever input costs, such as labor, feed, environmental requirements for waste disposal, etc., are minimal. The US poultry industry is now predominantly in the south-eastern states, where costs are lowest and environmental regulations the least stringent in the country. This is particularly true of the state of Arkansas, where integrators have had the additional incentive of political influence; the dominance of the poultry industry in Arkansas and the fact that the President of the US for eight years (1992-2000) is from that state are not totally coincidental (*Table 2*).

Table 2

Leading U.S. broiler and turkey producing states, 1996
(Feedstuffs Reference Issue, 1997)

Rank(1)	Broilers(2)	Turkeys(3)
1	Arkansas (19.2)	North Carolina (22.5)
2	Georgia (19.2)	Minnesota (16.4)
3	Alabama (14.5)	Arkansas (10.6)
4	North Carolina (11.3)	Virginia (9.4)
5	Mississippi (11.2)	California (8.5)
6	Texas (7.0)	Missouri (8.3)
7	Maryland (4.9)	Indiana (5.3)
8	Virginia (4.3)	Pennsylvania (4.4)
9	Delaware (4.3)	South Carolina (3.1)
10	Missouri (4.1)	Iowa (3.0)

Figures in parentheses are % of total production. (*Zárójelben az összes termelés %-os megoszlása.)*

2. táblázat: Az USA vezető brojler és pulyka termelő Szövetségi Államai, 1996

Rangsor(1), Brojler(2), Pulyka(3)

Other segments of the livestock industry in the US are rapidly industrializing, similar to what has occurred with poultry production. The “chickenization” of the swine industry is well underway.

In contrast to what has occurred with poultry, corporate take-over of swine production in the US has not been a smooth process. Largely because of environmental problems associated with air and water pollution, corporate swine production has become extremely controversial. So-called swine factories or swine mega-farms are not well received by communities in which they are located. There are many problems with swine odor, and the employment created is mainly low-income jobs which are mainly filled by immigrants rather than by traditional members of the community. Despite the controversies, one company, Seaboard Corporation, has expanded to where it now controls most of the US swine industry.

Industrialization of swine production will likely continue in the US, because in the short term at least, it is the most economically efficient system. It is interesting to compare US swine mega-farms with the history of former mega-farms in the Soviet-era state farm systems. The US mega-swine farms are economically efficient because they are highly automated and incorporate cutting-edge technology. Soviet-era state farms were labor intensive, with a lack of meaningful incentives for workers. A colleague of mine has commented that the state farm system would be analagous to the U.S. Postal Service raising pigs!

Animal Production and Use of Grains

It is a biological fact that it is more efficient for humans to directly consume cereal grains and plant proteins as sources of energy and protein, rather than feeding these materials to animals to produce meat. This issue is somewhat moot at this point, because of the massive crop surpluses and low farm prices for grains and soybean meal. Competition between humans and livestock for food resources is not likely to be a major societal concern for the forseeable future, especially in North America and Europe, which are plagued (or blessed?) with huge crop surpluses.

Food Safety and Health Issues

Modern animal production has encountered numerous food safety and health issues. Safety issues include microbial contamination of animal products, the prion-induced diseases (bovine spongiform encephalopathy and scrapie), and "chemicals and hormones" used as feed additives. Human health issues associated in general with consumption of meat, milk and eggs include coronary heart disease, stroke, obesity and cancer.

Microbial problems have included meat and egg contamination with *Salmonella*, *Campylobacter*, and enterohemorrhagic strains of *E. coli* such as *E. coli* 0157:H7. The significance of bovine spongiform encephalopathy (BSE) needs no explanation to a European audience. All of these problems can be dealt with on a scientific basis, and can be corrected by appropriate attention to hygienic measures. However, each outbreak of human illness caused by contaminated animal products further undermines public confidence and approval of animal agriculture.

The other major type of food safety issue, besides microbial contamination, is the use of feed additives, commonly perceived as "chemicals and hormones." Societal concern has been directed mainly at so-called "growth hormones" and antibiotics. This topic is too extensive to discuss in this paper, but certainly these issues are well known to Europeans. Again, the continual emergence of these issues in the public press, as well as chemical contamination of meat with dioxins as has occurred in Europe, has put animal agriculture in a negative light. This is particularly true with contamination of feed ingredients such as meat and bone meal, and dried poultry litter, which the public perceives as unsavory products anyway. The BSE outbreak in the United Kingdom brought to public attention the use of rendering products such as meat and bone meal as feedstuffs for livestock. Animal Scientists have long promoted livestock production as a means of converting human-inedible by-products such as meat meal and dried poultry waste into high-quality human food. The BSE scare has drawn attention to these practices, and the general public reaction is quite negative. A headline in a major US news magazine (US News and World Report) had an article with the headline "The Next Beef Scandal: cattle feed now contains chicken manure and dead cats." One of the requirements for the "organic" designation for meat in the US is that no animal by-products have been used in the feed of organically-produced livestock.

Health issues such as coronary heart disease and cancer have long been linked with consumption of animal products. Again, the subject is too extensive to be covered in this paper, other than to comment that these issues reinforce public sentiment that eating meat, milk and eggs is bad for human health. One of the few bright spots for animal agriculture has been the new evidence that conjugated linoleic acid (CLA) has anticancer activity (*Parodi*, 1997).

Environmental Effects of Intensive Animal Production

Industrialized animal production has resulted in ever-increasing animal concentrations. In the US, there are now mega-swine farms producing as many as two million pigs per

year, and dairy farms with 10,000-15,000 cows. Beef feedlots may have 50,000 or more cattle in confinement at one site. The poultry meat industry tends to be more dispersed, with birds distributed among contract growers, but in a geographical area such as the southeastern US states, the entire region may be contaminated with poultry manure. Environmental effects of large animal concentrations include air, water and soil pollution. Some of these effects are capable of achieving global significance, with transnational air pollution, and contamination of multi-national river systems, and the oceans. For example, it is believed the pollution of the Mississippi River with nutrients from animal production and from corn and soybean production for animal feed is causing a zone of anoxia and eutrophication of the Caribbean Sea.

Corporate Animal Production Exploits Workers and Has Adverse Social Effects

Corporate production of chickens and swine in the US has as its main goal the generation of maximum profit for the owners or shareholders. Pioneers in the development of corporate animal agriculture, such as Mr. Donald Tyson of Tyson Foods and Mr. Wendell Murphy of Murphy Family Farms, have become billionaires. Obviously, corporate animal agriculture has been good to them. However, a legitimate viewpoint is that their great wealth has been obtained through the exploitation of both animals and humans. As discussed above, corporate animal agriculture has become very intensive and automated, with little concern for certain aspects of animal welfare, and specifically those aspects involving the "telos." Similarly, the welfare of the people who do the work is often compromised. In the industrial poultry industry, the people who do most of the work are the contract growers and the processing plant workers.

Industrial production ("factory farming" to its critics) of chickens is cruel and inhumane in the opinion of many people. This perception seems to be based on the general reaction to layers kept in small cages, and broilers raised at high stocking density. No amount of pleading by scientists that the birds are not stressed or are not being abused simply to increase corporate profits is likely to modify negative public reaction to modern poultry production techniques.

Industrial production of poultry is perceived by many to have negative social consequences. Independent farmers have become growers, who are told what to do and when and how to do it. Many jobs in the poultry industry, especially in processing plants, are low-wage and often filled by an influx of non-local people. This leads to increased demands on the local infrastructure for low-income housing, schools, bilingual education programs, increased law enforcement costs, etc. These social costs are "externalized" by the poultry industry and not included in calculations illustrating the high efficiency of poultry production. In other words, these costs are assumed by the society at large, in taxes for new schools, subdivision services, bilingual education etc. These comments should not be misconstrued as being prejudicial or racist. Industrial poultry production and processing does introduce social issues that did not previously exist, which are left to the community itself to resolve. This results in the perception (and reality) that industrial poultry production has negative social consequences, and the costs of dealing with these consequences are not paid by the poultry companies but by the community.

Intensive production of poultry causes environmental (air, water, soil) pollution. Intensive production of poultry may impact food safety, with microbial pathogens such as *E. coli*, *Salmonella*, and *Campylobacter* spp. of concern. The costs of dealing with these health problems are externalized, or paid by society at large.

There are other large hidden or externalized costs associated with industrial poultry production. The intensive production of corn and soybeans to produce poultry feed

results in soil erosion and depletion of wildlife habitat, for example. Soil erosion and nutrient run-off in the mid-west can influence ecological conditions as far away as the Caribbean Sea, where a large anoxic "dead zone" is attributed to agricultural pollution brought in by the Mississippi River.

Industrialized poultry production is of concern to some people because of its effect on distribution of wealth. The philosophy behind vertical integration is to develop a single profit center (i.e. corporate headquarters). The people who do the work in the poultry industry are the growers (who raise the birds) and the processing plant workers (who slaughter, cut up and package them). These people are the most poorly paid links in the chain. Workers in poultry processing plants receive low wages, few benefits and little respect. The trend in hourly earnings for processing plant workers, corrected for inflation, is negative. Real earnings per hour were lower in the early 1990's than in the late 1970's and most of the 1980's (*Schrimper*, 1997). The average hourly wage of a poultry processing plant worker in 1995 was $5.27 (*Schrimper*, 1997). Meanwhile, Donald Tyson of Tyson Foods joined the Forbes 1997 list of the 400 richest people in the US, with a fortune of $1.2 billion. Some people view this disparity as a good example of corporate greed and unfair distribution of wealth.

The industrial poultry industry is well suited for globalization. Like the production of athletic shoes, industrial chicken can be produced wherever costs are cheapest and corporate profits maximal. Thailand, Russia and China are examples of countries attracting the poultry integrators. These countries are hungry for low-wage jobs. Industrialization of animal and poultry production may ultimately result in these industries moving to other countries, with the US importing meat rather than producing it domestically. This will also shift the demand for Animal and Poultry Scientists to the other countries. They will probably be trained locally, further reducing the demand for ASAS and PSA members. There could also be an increased demand for US-trained scientists.

Industrial farming has led to manipulation of the political system for corporate benefit (political gerrymandering). Examples include legislation allowing frozen chicken to be labeled as fresh, resulting in Arkansas broilers being "fresh" anywhere in the country. President Clinton's first Secretary of Agriculture, Mike Espy, was fired for receiving gifts from Tyson Foods. As Secretary of Agriculture, Mr. *Espy* was responsible for legislation and policies which could affect the poultry industry. Tyson Foods paid $4 million in fines and $2 million in investigation costs, but was not barred from continuing millions of dollars of sales to the US military and school lunch programs.

Political influence is probably also being exerted with land grant universities. The University of Arkansas Poultry Science Center of Excellence receives considerable funding from the vertically-integrated poultry companies. It is perhaps not unreasonable to suggest that these companies would expect to have some input into research, curriculum development and departmental function in return for their financial involvement. Having your own land grant university fits nicely into the vertical integration concept. Academic freedom, with the opportunity to express views such as those in this paper, would likely be compromised. You don't bite the hand that feeds you.

PROFESSIONAL IMPLICATIONS OF THE INDUSTRIALIZATION AND GLOBALIZATION OF ANIMAL AGRICULTURE

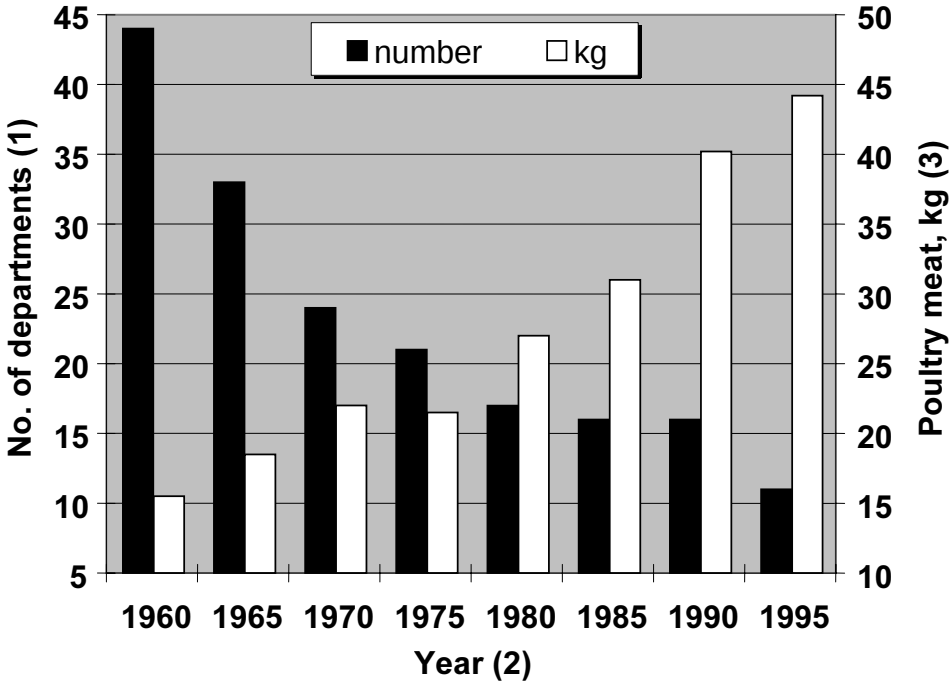
Industrial Poultry Production and the Discipline of Poultry Science

An interesting relationship is that as poultry production has industrialized and the per capita consumption of poultry meat has increased, the number of Departments of Poultry Science in the US and Canada has declined markedly (*Fig. 1*). Is there a cause and effect

relationship? Over the years, Poultry Scientists have expressed great concern and hand-wringing about the decline in Departments of Poultry Science. One of the earliest reports was that of *Sunde et al.* (1972) on "Problem of Disappearing Poultry Science Departments." They believed that the major reason for the decrease from 44 departments in 1960 to 21 in 1971 was the need by universities to eliminate classes with small enrollments. They concluded "The long term effects of the mergers of the 1960's will not be known for some time. The effects are just beginning to show and only time will tell the story as it should be told." Twenty-nine years later, the story seems to be that the mergers have not had a serious negative impact on the poultry industry. *Cook* (1988) documented a further decline to 16 departments by 1987, while *Beck* (1992) noted a further decline to 14 departments. She concluded "Vertical integration in the industry has led to specialization and decreased job availability, both in reality and in student perception."

Figure 1

Comparison of trends in the number of U.S. Departments of Poultry Science and per capita poultry meat consumption (adapted from *Pardue*, 1997)



1. ábra: Az USA baromfihúsfogyasztásásnak és a baromfitenyésztési intézetek számának változása (1960-1995)

Baromfitenyésztési intézetek száma(1), Év(2), Baromfihús, kg(3)

Beck (1992) asked two pertinent questions: "Why should a heavily integrated industry support scientific endeavors at universities? Why should (university) administrations support programs that attract few students?" Her answers were as follows: "Universities have the

capability to address long-term questions, animal welfare questions, and concerns of food quality and safety. Is it not short-sighted for industry to take the stance that university programs are obsolete and for universities to abandon such an important industry?"

Pardue (1997) conducted a survey of poultry meat producers to evaluate concern over the loss of Poultry Science departments and to assess future needs. While 44% of respondents noted "extreme concern" about loss of poultry programs, they ranked communication and business skills as being much more important than a poultry background as desired skills and training in prospective employees.

Having done yeoman's service in aiding the industrialization of the poultry industry, Poultry Scientists find themselves in the unfortunate situation of having worked themselves out of their jobs! Does this fate await Animal Scientists?

Industrialization of Large Animal Production

The poultry industry is almost completely industrialized. Per capita consumption of poultry meat is increasing rapidly in the US (*Fig. 1*), as poultry takes over an increasing proportion of market share. Other meat industries are responding with a trend to industrialization, to attempt to remain competitive with poultry.

Efforts to build corporate swine mega-farms have been accompanied by great public debate about corporate farming, and air and water pollution. The industrialized swine industry has developed most rapidly in North Carolina (*Table 3*), where it has been implicated in swine lagoon failures, pollution of rivers and ground water, and air pollution from swine odor.

Table 3

Swine numbers in leading U.S. states, 1996
(Feedstuffs Reference Issue, 1997)

Rank and State(1)	Numbers of pigs (thousands)(2)	% of total U.S. inventory(3)
1. Iowa	12,200	24.1
2. North Carolina	9,300	18.4
3. Minnesota	4,850	9.6
4. Illinois	4,400	8.7
5. Indiana	3,750	7.4
6. Nebraska	3,600	7.1
7. Missouri	3,500	6.9
8. Ohio	1,500	3.0
9. Kansas	1,450	2.9
10. Oklahoma	1,320	2.6
11. South Dakota	1,200	2.4
12. Michigan	1,000	2.0
13. Pennsylvania	950	1.9
14. Arkansas	825	1.6
15. Wisconsin	800	1.6
Total(4)	**50,645**	**90% of total U.S. inventory(5)**

3. táblázat: A legnagyobb sertéshústermelő Szövetségi Államok az USA-ban, 1996

Rangsor és állam(1), Sertések száma (ezer)(2), Az Egyesült Államokban összesen nyilvántartott, %(3), Összes(4), Az Egyesült Államokban összesen nyilvántartott, 90%-a(5)

In 1997, the Governor of North Carolina proposed a two-year moratorium on the construction of new swine facilities, to attempt to solve some of the environmental problems. In 1999, Hurricane Floyd slammed into North Carolina, causing extensive failure of swine waste lagoons, and unprecedented pollution problems.

There is now a trend for swine production to move to sparsely populated areas, to try to minimize environmental concerns. Wyoming, Utah, Colorado, Oklahoma, and other western states with abundant open space are developing large corporate swine industries. Much of the western US is arid and semi-arid. Swine farms utilize large amounts of water, creating water-use conflicts. Pollution of ground water and aquifers with swine waste is also of concern. In 1997, the Governor of Oklahoma declared an emergency measure to regulate corporate swine farming, in response to public demands that politicians curb the state's expanding sow herd. The Oklahoma swine population has quadrupled since 1991. Air pollution (swine odor) of pristine areas such as the Grand Canyon and National Parks in Utah is also of potential concern.

Corporate swine producers are looking at Canada, Brazil, and Argentina as sites for expansion, to avoid the controversies in the US. For example, Seaboard Corporation, frustrated by attempts to build a large swine operation in Oklahoma, has purchased one-half million acres (700 square miles) in Argentina.

The development of corporate pig farming in the US with unrestrained pig production in the 1990's has resulted in unprecedented low prices, and in early 1999, severe economic effects on hog farmers. A headline in Feedstuffs magazine (Feedstuffs, Dec. 21, 1998, p. 1), proclaimed "Independent pork production may be in last desperate year." Under a subheading in the article "Chicken time for pigs," it is stated "…the industry will begin its final transition from the independent pork sector of past years to one that looks and acts like the chicken industry." Thus by swamping the market with excess production, corporate swine farms have effectively eliminated traditional, family farm-oriented pig production. Corporate farms have deeper pockets than family farmers, but nevertheless, they have appealed to the federal government to bail them out, despite themselves causing the hog crisis by recklessly expanding production.

It is apparent that industrial swine production is not popular with the US public. A rational person might well ask if there isn't a better way to produce pork. Why build swine mega-farms? Corporate greed may be part of the answer. In 1997, *Wendell Murphy* of "Murphy Family Farms" joined Donald Tyson as an inductee into the Forbes 400 list of the 400 richest Americans, with a net worth of $1 billion. According to *Thu* and *Durrenberger* (1994), *Wendell Murphy* was investigated by the North Carolina Bureau of Investigation for possible illegal financial dealings while he was a state senator. While a senator, he apparently played a pivotal role in developing legislation to assist corporate swine farms, including having intensive swine farms exempt from conducting environmental impact studies or hearings. Residents in North Carolina received no advance notice of the construction of these swine facilities in their neighborhoods, and had little or no opportunity to raise questions or voice concerns.

Animal Scientists may be shooting themselves in the foot if they continue to promote intensive swine production. The main reason for the development of swine megafarms seems to be so that a few people can get rich, at the expense of many other people and the environment. For example, pollution of estuaries on the east coast with swine and poultry manure is causing biological changes and the emergence of new fish diseases due to polluted water. One of them is a toxic algae, *Pfiesteria piscicida*, which has been implicated in causing extensive fish kills (*Noga et al*., 1996). This organism is also toxic to humans, causing open sores, nausea, memory loss, fatigue, disorientation

and incapacitation. The toxic algae is a dinoflagellate, a class of single-celled aquatic organisms which exhibits both plant and animal characteristics. It has a complicated life cycle involving toxic and nontoxic forms. Water pollution is one of the factors causing the formation of an "ambush-predator" form which attacks fish and immobilizes them with a highly poisonous neurotoxin (*Burkholder* and *Glasgow*, 1997).

The continuing push to develop swine megafarms has an adverse effect on Animal Science. Animal Scientists are perceived as active promoters of and apologists for a system of animal production that is disliked by the general public. At the very least, Animal Scientists should be perceived as people seeking to alleviate the environmental effects caused by intensive animal production.

Membership in Professional Societies

As with the poultry industry, industrialization of livestock production will likely decrease the need for people who have traditionally been American Society of Animal Science (ASAS) members, such as nutritionists, geneticists, extension specialists, consultants etc. Part of the perceived efficiency of intensive animal production is due to automation and reduced labor requirements, including the need for Animal Scientists. "Perceived efficiency" is a deliberate choice of a term. Producing corn and soybeans in Iowa to ship them by rail to the Utah desert to feed pigs may be a short-term economic efficiency, but does not seem to meet the tenets of sustainable agriculture. We have emphasized short-term economic efficiency and cheap food at the expense of the natural, social and cultural environments.

One major difference between the Disciplines of Poultry Science and Animal Science is that Poultry Science was never particularly popular with students, whereas Animal Science Departments have had large enrollments. Undergraduate students enter Departments of Animal Science because they want to work with domestic animals. In many cases, their career goal is Veterinary Medicine. For the past four years, I have been conducting a survey of the incoming class of Animal Science students at Oregon State University (OSU). The student profile is that they are female (77-88% of total over the 1995-1998 period), 20 years of age or less (85-88% of total), and from an urban background (32-62%). The main reasons for choosing Animal Science as a major were: (1) I love animals (89-93%), and (2) I want to be a veterinarian (69-77%). The animal species I am most interested in are: (1) horses (42-53%), and pets (9-38%). For other species (beef cattle, dairy cattle, sheep, swine, and poultry), only one or two students a year identified these as the animal species they were most interested in. For OSU, I conclude that the incoming students in the Department of Animal Science are young women from urban areas of western Oregon, who love animals and want to become veterinarians, and who are primarily interested in horses and pets.

This student profile does not seem consistent with a potential surge of ASAS memberships in the future. While Oregon may not be entirely representative of the US, animal agriculture is an important part of the state's economy, with beef cattle ranching and dairying being major activities. On the other hand, perhaps this student profile holds the salvation for ASAS. If, as I have projected, intensification of animal production is decreasing the need for Animal Scientists in their traditional roles, perhaps we can find new opportunities. An astounding 88% of the incoming OSU Animal Science students in 1997 were female. Assuming that many or most of these students will not enter the field of Veterinary Medicine, what career options in Animal Science do they have? At OSU, student numbers in Animal Science are increasing. Poultry Science Departments never had the luxury of large enrollments over the last 25 years when they were being closed

or merged. This is an advantage that Animal Science Departments have; we still attract large numbers of students. There is an urgent need to develop new opportunities for young people who "love animals," especially horses and dogs, and who, therefore, may not be attracted to "factory farming" of animals (these are not mutually exclusive, but I perceive that people who "love animals" are not usually excited about intensive animal production).

Both Animal Science and Veterinary Medicine are, at many universities, experiencing the phenomenon of student enrollment being primarily female. *Miller* (1998) referred to this as "feminization of the veterinary profession." She predicted that by 2004, 50% of veterinarians in the US will be women. *Schillo* (1998) discussed the issue of increased participation of women in the discipline of Animal Science. According to *Schillo* (1998), the Animal Science community has traditionally embraced methods and outlooks that reflect values consistent with masculine views and experiences, and claims "Most of the studies reported in the Journal of Animal Science assume an industrialized, capitalistic society based on economic growth and competition. The type of agricultural research system that corresponds to these conditions is one that values control and economic efficiency more than it values rural communities or sustaining the well-being of farm families and ecosystems. Efficiency is the dominant value of the economically privileged men who have controlled agriculture since the scientific revolution." *Schillo* (1998) maintains that Animal Scientists attempt to socialize female students to acquire male traits of aggression, competitiveness and dominance, perpetuating professional behaviors that have got us to where we are now, which is an animal agriculture increasingly dominated by the industrial model. The great influx of female students into Animal Science offers the potential for a redirection of the discipline, embracing other values in animal production besides economic efficiency. *Schillo* (1998) concludes "The animal science community could more effectively cope with issues if it would develop a social climate that encourages individuals with diverse perspectives to express their views in their work." The Animal Science community is often blind-sided by controversial issues, and responds inappropriately to them. Perhaps encouragement of diverse viewpoints and backgrounds in the education of Animal Science students would better prepare them for the rigors of responding to controversial issues as they emerge.

I believe that Animal Scientists have not fully exploited the opportunities that are available to increase interest in the profession. It has been a common practice among many Animal Scientists in the US to complain about student interest in Veterinary Medicine, with an undercurrent attitude that our egos are bruised because Animal Science is not their first choice. A reasonable objective would be that every pre-vet student should be an Animal Science major. At OSU, for instance, an increasing number of the pre-vet students register in the College of Science (Zoology) rather than in Animal Science. *Gloyd* (1998), in a summary of a veterinary meeting on "Agribusiness opportunities for veterinarians," described comments of Dr. *W.C. Wagner* of the USDA: "He (W.C.W.) called for more cordial relationships between veterinary medical colleges and animal science departments." He suggested that veterinary schools "join with animal science departments to recruit high school students into a joint six-year program heavily oriented to business, agricultural engineering, animal production, and economics." This type of program, offered collaboratively by animal scientists and veterinarians, could provide many opportunities for students who initially are pre-vet students, but who for whatever reason do not enter DVM degree programs.

Another opportunity is to exploit the high student interest in horses and companion animals, and work to develop career opportunities in these areas. Dog and cat nutrition has largely been left to the Veterinary profession, mainly by default. We have high student interest in these areas; what can we do to take advantage of this interest? One thing we can do is recognize that horses and other companion animals are a legitimate component of the discipline of Animal Science. I recall an Animal Scientist who described high student interest in horses as "sick"! This sort of attitude is incompatible with current student interests. In fact, in view of the changes in Animal Science discussed in this paper, and the trend towards industrialization and globalization, student interest in horses may be the salvation of many Animal Science departments. While poultry production may move to Thailand and swine production to Brazil, it would be impossible for the US equine industry, based on recreational riding, to move abroad.

DISCUSSION

My opinions can be summarized as follows.

- The decline in the number of Departments of Poultry Science is directly attributable to the industrialization of poultry production. Poultry production has become highly automated and technologically sophisticated. Poultry Scientists played a major role in these developments, which in turn have rendered many of them redundant.
- In order to attempt to remain competitive with poultry, other meat industries will industrialize, as is happening now with the swine industry, either to try to preserve market share in competition with poultry meat or to gain the corporate economic opportunities of large enterprises. Both factors are currently involved in the rapid development of industrial pork production. The beef industry is concerned with its declining market share, which has been lost primarily to the industrial poultry sector.
- The industrialization process, by intensifying animal production with large numbers of animals kept at high stocking density in confinement, reduces the number of scientists required by the industry. One nutritionist can formulate diets for many more animals than in the past. A large swine facility, such as Circle 4 Farms in Utah which plans to have 120,000 sows, needs fewer nutritionists, geneticists, extension agents etc., than are required to service 120,000 sows distributed on family farms in Iowa. Thus fewer scientists with MS/PhD education, who would be potential ASAS members, are likely to be employed as animal agriculture industrializes. Many of the management positions which might formerly have been filled with BS Animal Science graduates may become redundant and be eliminated as a result of industrialization.
- Industrial animal production will require fewer technically trained people than traditional agriculture. Thus it is more or less inevitable that the numbers of Animal and Poultry Scientists needed to service the livestock and poultry industries will decline. Fewer university programs will be needed to train this reduced number of people. Fewer academics, fewer students, and fewer people in industry will inevitably result in a decline in membership of professional societies such as PSA and ASAS, particularly as those presently in mid-career or tenured positions retire, unless new opportunities in non-traditional employment positions are created. For example, industrialization of poultry production has led to an increased demand for avian pathologists to deal with disease problems that have accompanied the development of the industrial poultry industry (e.g. broiler ascites, spiking mortality syndrome, and other "diseases of industrialization.")

- Academics in Poultry and Animal Sciences have in general supported and contributed to the industrialization and technological sophistication of animal production. In doing so, they have contributed to the automation of animal production. Automation increases efficiency by reducing the number of people required, including Animal and Poultry Scientists. Increased efficiency has been our mantra for many years.
- An increasing number of people are disenchanted with industrial animal production. Issues such as animal rights, food safety, "chemicals" as feed additives, use of hormones, global capitalism etc., are "turn-offs" to many people, particularly to young people. Industrial animal production is leading to an increase in vegetarianism, as young people are "turned off" by meat production systems which they view as factory farms, with animals serving as meat machines to fill up the coffers of global capitalists. In the long term, this is likely to further reduce the need for Animal Scientists, if our current methods of animal production spawn a generation of vegetarians.
- Intensification of animal agriculture has led to geographical concentration of production. Many U.S. states no longer have significant poultry industries, so it is no surprise that their land grant universities no longer have Departments of Poultry Science. This has reduced the number of potential members of PSA. As production of other livestock becomes geographically concentrated, will some US states decide that animal agriculture in that state no longer justifies a Department of Animal Science? Is ASAS on the same slippery slope with Departments that the Poultry Science Association (PSA) has been on over the last 25 years? One response of Departments of Animal Science to geographical concentration of livestock species may be to specialize in just one or a few species, an option that was not available to Departments of Poultry Science.
- An opportunity for the discipline of Animal Science is to develop new systems of animal production which address the societal concerns with the industrial model. Can we escape from the mentality that bigger is always better? Can we develop systems that are more humane to both humans and livestock than the industrial systems that are dominating animal agriculture now? If we simply want meat machines, we must recognize that it takes only a few technicians to keep a machine running smoothly, and that a decline in ASAS membership is inevitable and desirable, as a means of promoting efficiency. The final irony of our obsession with efficiency is that it means most Animal Scientists will become redundant, as has been the fate of Poultry Scientists. Can or should Animal Scientists avoid a similar fate?
- In this article, I have presented my perception of why the poultry industry industrialized, why production of other animal species may follow the same path, and suggest alternatives that might be considered. Are we stuck into two paradigms: the industrial model, or the farm of the 1950's? Are there other alternatives, that may be more humane and more sustainable than the industrial poultry model?

REFERENCES

Beck, M.M. (1992). Status of Poultry Science Departments and poultry research within combined departments. Poult. Sci., 71.1328-1331.

Burkholder, J.M., and H.B. Glasgow, Jr. (1997). Trophic controls on stage transformations of a toxic ambush-predator dinoflagellate. J. Eukaryotic Microbiol., 44. 200-205.

Cheeke, P.R. (1999a). Contemporary Issues in Animal Agriculture, Second Edition. Interstate Publishers, Inc. Danville, Illinois.
Cheeke, P.R. (1999b). Shrinking membership in the American Society of Animal Science: Does the discipline of Poultry Science give us some clues? J. Anim. Sci., 77. 2031-2038.
Cook, R.E. (1988). Poultry research programs in the future. Poult. Sci., 67. 890-896.
Gloyd, J. (1998). Agribusiness opportunities for veterinarians explored. J. Am. Vet. Med. Assoc., 213. 1679-1687.
Miller, G.Y. (1998). Earnings, feminization, and consequences for the future of the veterinary profession. J. Am. Vet. Med. Assoc., 213. 340-344.
Noga, E.J. L. Khoo, J.B. Stevens, Z. Fan, J.M. Burkholder (1996). Novel toxic dinoflagellate causes epidemic disease in estuarine fish. Marine Pollution Bull., 32. 219-224.
Pardue, S.L. (1997). Educational opportunities and challenges in Poultry Science: mpact of resource allocation and industry needs. Poult. Sci., 76. 938-943.
Parodi, P.W. (1997). Cows' milk fat components as potential anticarcinogenic agents. J. Nutr., 127. 1055-1060.
Pingel, H. (2000). Welfare problems in EU intensive waterfowl production. World Poultry, 16. 34-38.
Rollin, B.E. (1995). Farm Animal Welfare. Social, Bioethical and Research Issues. Iowa State University Press, Ames.
Schillo, K.K. (1998). Toward a pluralistic animal science: postliberal feminist perspectives. J. Anim. Sci., 76. 2763-2770.
Schrimper, R.A. (1997). U.S. Poultry processing employment and hourly earnings. J. Appl. Poult. Res., 6. 81-89.
Sunde, M.L., Hartung, T.E. Jensen, L.S. (1972). Problem of disappearing Poultry Science Departments. Poult. Sci., 51.1079-1087.
Thu, K., Durrenberger, E.P. (1994). North Carolina's hog industry: The rest of the story. Culture and Agriculture, 49.20-23.
Webster, A.J.F. (1994). Meat and right: the ethical dilemma. Proc. Nutr. Soc., 53. 263-270.

Corresponding author (*levelezési cím*):

P.R. Cheeke
Department of Animal Sciences
Oregon State University, Corvallis, OR 97331 USA
Oregon Egyetem
Állattudományi Intézet, Corvallis, OR 97331 USA
Fax: 541-737-4174
e-mail: Peter.R.Cheeke@orst.edu