



# FUTURE OF THE POULTRY INDUSTRY



A collection of original, forward-looking articles published to commemorate WATT Global Media's 100 years of serving the global poultry industry.

## PLUS

- 12 poultry industry trailblazers
- Historical timeline of WATT publications

US \$199

# Future of the poultry industry

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# Future of the poultry industry

To celebrate the company's 100 years of service to the poultry industry in 2017, WATT Global Media prepared a series of articles which, look at the future of 13 key areas that will shape the future of poultry production and processing. The future may prove a bit differently, but we hope to give an indication of how technologies and market forces might emerge and impact the industry in the future, and that the articles provide food for thought.

The articles in this series were written by WATT Global Media editors and an invited group of outside experts. As a bonus, Paul Aho's article, "12 people who transformed US poultry production," is included in this collection. It offers a look back at the pioneers who helped create the modern broiler industry in the U.S.

We hope you enjoy this series of articles looking at the future of the world-wide poultry industry. We also invite you to follow our coverage of the poultry industry in our second 100 years to see how many of our predictions are correct.

Wishing you continued success,

Terrence O'Keefe  
Content Director



# Future of poultry breeding, balanced genetic selection

Geneticists say economically important traits will improve as balanced selection efforts result in broilers and layers that perform well and have high welfare under a variety of management and nutritional regimens.

TERRENCE O'KEEFE

In the developed world, the broiler and layer industries find themselves in an unusual situation. Performance measures for livability, growth rate, feed conversion, and carcass and slaughter yield have never been better for broilers, and the same is true for persistency of lay, livability and feed conversion for layers. However, activist group activities and consumers in the developed world have a heightened interest in animal welfare and transparency, so poultry producers are being challenged to manage their flocks so they are productive and presentable for a photo shoot throughout their lives.

## Selecting layers in varied environments

Fortunately, poultry breeding companies recognized these consumer and activist trends years ago and began adapting their selection programs to produce genetic stock that is adaptable to multiple housing situations, has improved performance on bird welfare measures and continues to be more productive with each generation. The movement out of cages for laying hens started in Europe, but it is spreading rapidly to

North America. Laying hen strains have proven adaptable to cage-free environments because breeders began adding cage-free environments for their selection lines more than 20 years ago.

Frans van Sambeek, research and development director, ISA, said selection for the important cage-free behavioral traits like nesting behavior and lower aggressiveness won't really slow progress on economically important traits like persistency of lay or egg size and qual

**Broilers will likely continue to have the potential to be raised to higher weights as balanced selection continues to improve welfare and meat quality traits, rate of weight gain and feed conversion rates.**

*Photo courtesy of Cobb-Vantress*



ity, because this balanced approach to selecting breeder candidates is being helped by genomic techniques.

Santiago Avendano, senior geneticist, Aviagen, explained: “Genomics is especially important for attributes for which there is a limited amount of individual records at the time of selection, like sex-limited traits. For instance, in the past we have been able to make a prediction of the genetic potential for egg production or hatchability of a male selection candidate based on the qualities of its family, but with genomics we can now see exactly the genetic configuration of each selection candidate and use it for predicting its genetic potential more accurately.”

### Feather coverage

Feather coverage on laying hens provides an example of where what might be thought of as a welfare trait has actually proven to be a trait that is of increasing economic performance.

“Selecting for feathering is an important trait from a feed efficiency point of view so that hens are not overeating (to maintain body temperature), but it is also important from a consumer and society point of view because in free range or in aviaries, consumers want to see the welfare of the birds,” said van Sambeek.

Cage-free houses provide more space per hen and this makes temperature control in the layer house more of an issue in the winter months, so better feather coverage can save on feed and fuel costs.

### Preparing for beak trimming bans

Dr. Neil O’Sullivan, research director, Hy-Line International, said the company discontinued beak trimming selection candidates more than 20 years ago. He said they didn’t document beak shape when they first started selecting nonbeak-trimmed birds, but he said that their perception is that beak shape might have changed slightly. However, the big change has been in the bird’s behavior.

“Now it is the decision of the farm management to beak treat,” O’Sullivan said. “If birds are in open-sided houses, they probably need to be beak trimmed, but you don’t have to otherwise.”



**Poultry breeders see paradigm shift with genomic selection:**

[www.WATTAgNet.com/articles/9697](http://www.WATTAgNet.com/articles/9697)

### Finding solutions to breast meat myopathies

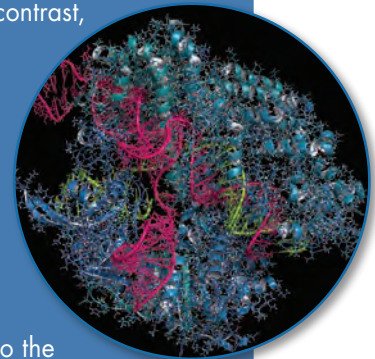
Breeders have been quite successful in increasing the breast meat yield of broilers. In some markets, particularly in the U.S., birds raised for deboning are routinely processed at 9 pounds (4.1 kilograms) live

## Will genome editing be accepted in poultry?

Genome editing is the process where the native genome of an organism is precisely corrected or adjusted. This technique is beginning to be used in human medicine where the patient’s genome is precisely manipulated to achieve a therapeutic effect. In contrast, genetically modified organisms (GMOs) have had transgenic introduction of foreign DNA sequences, which is different from genome editing where no foreign DNA is introduced into the organism’s genome.

The poultry geneticists interviewed for this article all cited genome editing as a technology with potential to affect genetic selection and breeding in the future, but they stressed that it is uncertain whether consumers and society will make a distinction between genome editing and genetically modified organisms when it comes to food-producing animals. Genome editing has not been employed in poultry at this time.

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## FUTURE OF POULTRY BREEDING, BALANCED GENETIC SELECTION

weight or more. Along with these larger birds, processors are seeing increases in white striping and woody breast muscle myopathies.

All breeders report gathering information on several meat quality traits in birds at processing to gather information about individual birds and families.

According to Dr. Derek Emmerson, vice president of research and development at Aviagen, “These are combined with indirect measures on selection candidates to identify birds with the condition while they are still alive and provide a very accurate way to identify which indi-



Austin Alonzo

**Primary breeders began raising selection lines in a variety of housing situations and nutritional regimes decades ago so that the industry would be prepared for changes in how birds might be housed and fed in the future.**

viduals are developing wooden breast. We have also increased our emphasis on traits such as cardiopulmonary function to provide a better physiological foundation to support improved meat quality and reduce the impact of one of the important risk factors for meat quality, namely, hypoxia or tissue ischemia.”

The root causes of these muscle myopathies is not fully understood, but researchers are actively looking for solutions.

Dr. Mitch Abrahamsen, senior vice president of research and development, Cobb-Vantress, said: “Cobb currently works with researchers on three different con-

tinents to find solutions, both short term and long term, to meat quality issues that are seen in the industry.”

### Selecting the broiler of tomorrow

Given all the considerations of selecting for welfare traits and efficiency, breeders were asked if birds raised for deboning would continue to get larger in the future.

“There might be a physiological limit or at least a physiological optimum, which most likely has not been reached yet,” said Yves Jego, director of research and development at Hubbard. “It is not just a matter of what the physiological limit will be, as these kind of extremely heavy broilers need to be grown under completely different management (growth profile, feed, lighting, housing, density, etc.) to get the maximum saleable final product.”

“Short term – yes. Long term – it depends,” Abrahamsen said. “There are metabolic limits that have been reached at some of the heavier weights, but we had similar issues with ascites in the past. The integrations learned how to manage or limit the issues, while the breeding companies worked on identifying families that were healthier. These same principles apply to metabolic challenges that are faced today at heavier weights or faster growth rates.”

“Selection for welfare traits including leg strength, gait, foot pad integrity and cardiopulmonary health provides a better physiological foundation to support field livability and bird welfare,” Emmerson said. “In addition, pedigree lines are selected across a range of different environments including drug-free production with exposure to common enteric challenges. This has allowed us to develop breeds which are adapted to processing at higher weights and under antibiotic-free conditions.”

“The real question of the upper limit for deboning birds is a broader one and will be determined by a number of different factors e.g., market factors, product use and consumer acceptance.” ■



100 YEARS  
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# Seed biotechnology: The impact on animal production

Agribusiness looks to biotechnology to improve crop protection, traits to feed the world of 2050

JACKIE ROEMBKE

Over the course of two decades, genetically modified (GM) crops have offered many benefits to farmers, consumers and the environment, including the use of fewer pesticides, larger yields and lower food and animal feed costs.

According to Robert Fraley, Monsanto executive vice president and chief technology officer, GM technology has increased crop yields by “an average of 21 percent worldwide and reduced the use of pesticides by 37 percent.”


Today, 28 countries legally grow GM crops, most commonly corn, soybeans and cotton. For example, in the United States, GM seeds account for 93 percent of corn and 94 percent of soybean production.

While many countries ban or prohibit the cultivation of GM crops due to regulations, trade concerns and public perception, they allow for the import of GM products, i.e. raw materials, animal feed and processed human foods.

Only seven countries have completely banned GM cultivation and imports.

Politics aside, the world is facing very real challenges that may prompt further exploration into the potential of seed biotechnology. By 2050, food production will have to increase by 70 percent to feed a global population of 9.7 billion. To do so will require intensification in crop and animal protein production.

For those working in animal agriculture and its allied



**ADVANCES IN SEED BIOTECHNOLOGY**  
will enhance crop traits to lower feed costs and improve animal health in the future, but political and social obstacles may hinder such progress.

motorolka, Bigstock.com



## SEED BIOTECHNOLOGY: THE IMPACT ON ANIMAL PRODUCTION

industries, the availability, quality and price of feed-stuffs is an evergreen concern. Looking to the future, the following innovations will play a large part in securing a sustainable and abundant cereal supply. However, in the short term, GM seed technology must overcome a series of significant obstacles.

### Key areas of seed biotech research

Seed biotechnology introduces genetic variations outside of the crop species' natural traits, allowing the farmer to be more efficient and profitable while leaving a smaller environmental footprint. For animal food producers, the selection of certain traits can reap considerable benefits for their bottom line.

Conducted in the public and private sectors, here are four areas of seed biotechnology innovation that will directly affect the producer's margins and improve animal health:

#### 1. SUPPLY: Higher yields

The UN's Food and Agriculture Organization (FAO) reports 90 percent of the growth in crop production will come from "higher yields and increased cropping intensity." Eighty percent of that growth will come out of developing countries.

We "will have to have more intensification," says Dr. Tom Clemente, professor with the University of Nebraska-Lincoln's Department of Agronomy and Horticulture. "We need more corn or soybean crops that can grow in higher density because we have less arable farm land."

Genome editing holds a lot of promise in increasing yield potential beyond crop protection.

#### 2. PROXIMITY: Climate adaptability

Research is being conducted in hopes of producing drought- and frost-resistant varieties of row crops as climate change will impact what's being planted and where.

"That's going to be the real influence of climate change — can the plant handle extreme conditions at critical times?" Clemente says.

The European Commission's DROP program is exploring "genetic patterns linked to water efficiency and drought resistance" in corn, wheat and sorghum.

#### 3. SAFETY: Mycotoxin resistance

With weather extremes comes the increased threat of mycotoxins.

According to the U.S. Food & Drug Administration



Future of biotechnology, feed exports hinges on EU-US trade talks

[www.WATTAgNet.com/articles/22104](http://www.WATTAgNet.com/articles/22104)

(FDA), mycotoxin contamination causes \$1.64 billion in revenue losses annually, but that figure will likely be driven higher with climate shifts.

Researchers are developing fungus-resistant seeds to assist in preserving pre- and post-harvest grain quality.

#### 4. NUTRITION: Nutrient manipulation

According to the International Service for the Acquisition of Agri-Biotech Applications (ISAAA), the nutritional enhancement of GM crops "targets manipulation of levels of proteins and amino acids, fats and oils, vitamins and minerals, carbohydrates and fiber quality, as well as decreasing the levels of undesirable components in major feed crops."

GM corn, for example, is being developed to include higher levels of methionine and strides are also being made in eliminating antinutrients from other feed grains.

#### Will mega mergers stall innovation?

During the past year, six of the seven largest seed producers announced merger and acquisition (M&A) plans: ChemChina's \$43 billion bid to takeover Swiss seed and pesticide group Syngenta; German drug



and crop chemical maker Bayer's aim to acquire U.S. seed company Monsanto for \$66 billion; and U.S.-based Dow Chemical's \$130 billion merger with DuPont.

"It benefits seed companies to be low-cost producers," explains



endomotion, Bigstock.com

### Ongoing seed biotechnology research strives to increase yields and mitigate on-farm challenges for feed crops, like soybeans and corn.

Elizabeth Hund, senior vice president and division manager of U.S. Bank's food industries division. "During a broad downturn in commodity prices, M&As will allow the big seed companies to survive. They'll be able to reduce costs and become more efficient, which better positions them to deliver margin on their stock."

Critics argue that the elimination of competition violates antitrust regulations, threatens food security and may suppress innovation. Hund believes mergers can spark the research and development of new products.

"These companies will continue

to try and extract value, and that's going to be through innovation and differentiation — all the technology that they can cultivate," Hund says.

In addition, she suspects secondary opportunities may present themselves as new divisions spin off the merged portfolios and the companies explore new sources of revenue generation.

Respective regulatory bodies plan to approve or deny the legitimacy of these transactions in early 2017.

### Threats to progress

There are a series of legal, social and economic challenges repressing new seed technologies. Public perception and excessive regulation pose the greatest obstacles to the development of the necessary advances in biotechnology.

The cost of regulation has become "an almost insurmountable challenge" for the development of many new biotech products, says Dr. Wayne Parrott, professor of plant breeding and genomics with the University of Georgia.

"The cost is inversely proportional to the risk involved," he says. "Spending \$30 million on safety tests gives the same level of safety that \$2 million to \$3 million does."

"Regulation is absolutely stifling innovation," Parrott notes. "Theoretically, if a country does safety testing by the CODEX Standard, that testing should be accepted around the world, which is the

case for every single food except for GMOs where you see many countries wanting to run their own tests."

Meanwhile, the consumer's perception of GM foods has been tarnished by activists and misinformation, culminating in the United States' push for GM labeling laws.

"You know, I have been in this business my whole career and I have never been pessimistic until this past year," Parrott says. "The point of no return, I think, is the labeling law. We avoided the labeling issue — the 50-different-labels issue at a national level — but not at the international level."

### Feed, animal protein industries key to biotech's success

Despite long-term challenges, food industries likely will prevail in shifting the public dialogue out of sheer necessity. In the short term, however, it's animal feed and food producers who will make the case for safe and cost-effective GM grains and the progression of seed research.

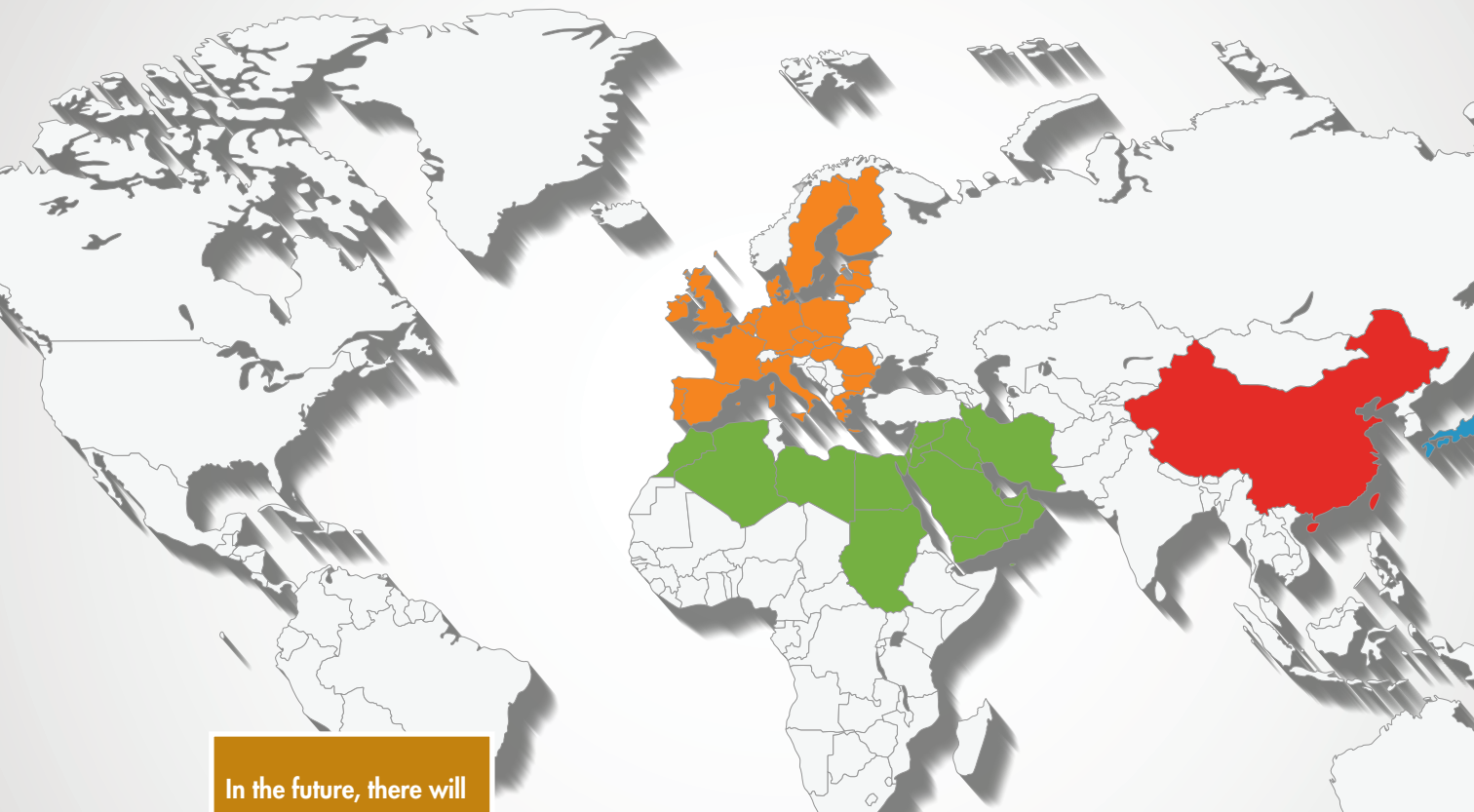
"The amount of [new GM seed varieties] with no hope of seeing daylight is just astonishing. It has nothing to do with the safety of the products; it has everything to do with over-regulation," says Parrott. "It's the feed sector where this technology has the best chance of succeeding and moving forward." ■

*References available upon request.*

# The future of poultry health: New and old challenges

Experts predict the major poultry health challenges over the next few decades will be caused by endemic avian influenza and Newcastle viruses, cage-free egg production, and antibiotic-free growing programs.

BENJAMÍN RUIZ



**In the future, there will be new vaccination programs and new concepts such as a universal poultry vaccine, with multiple viruses or antigens.**

*Courtesy Merial*

Two focal points of avian health in the future will be viruses – such as avian influenza and Newcastle – that have become endemic in some regions, and the impact of new trends in poultry and egg production, experts say.

In developed countries, diseases such

as avian influenza and exotic Newcastle virus are eradicated by euthanizing infected flocks. But this practice is not uniformly followed among poultry producers in less developed countries, resulting in diseases that are endemic in some regions.

Respiratory and enteric diseases will continue to shape the poultry industry, one expert says.

“I do not think that we will face new diseases, but rather more types of variants – as with avian flu – and with more intensity,” says Sylvain Comte, director of poultry business at Ceva Santé Animale.

## Endemic avian influenza

Avian flu has evolved to become the primary concern among the catastrophic infectious diseases in poultry.

Forty years ago, “talking about avian flu was like talking about something that happened in another world,” says Dr. Miguel Angel Marquez, a Mexican member of the ad hoc group on Newcastle disease at the World Organisation for Animal Health (OIE) in Paris. Now, avian flu is addressed in a more detailed manner and taken more seriously.

While the poultry industry has grown in Asia and Africa, those regions do not address disease like the U.S. and Europe do.

“One of the things we’ve seen in the last 10 or 15 years is that these countries do not have the same dedication and concept to eradicate highly pathogenic avian flu as in the U.S. or Europe, where it is eradicated at all costs,” says Dr. John Glisson, vice president of research programs at the U.S. Poultry & Egg Association.

“The H5N2 and H7N3 strains have been a real disaster for Mexico, but we did not proceed to the total slaughter of the birds,” Marquez says. Most worrying is that both viruses are circulating in the country, are endemic and vaccination continues.

By not eradicating the avian flu virus, it continues to spread and mutates, so it becomes a problem around the world.

“This has forced us to change: We used to not worry about avian flu, because we never thought there was going to be a constant source of the virus,” Glisson says. In the future, it is likely that avian flu will be present in new countries.

## Ubiquitous Newcastle disease

Another concern is Newcastle disease (ND); the OIE receives more notifications of ND than any other. There are ways to control ND, including vaccines, biosecurity measures and mobilization controls of products and byproducts.

“Newcastle is so endemic in many countries, which is also a major risk to the global poultry industry,” Glisson says. “For many years, some countries have decided not to eradicate it, like Mexico. It is a major concern for the U.S. and Canada.”

But it is not a concern in only the U.S. and Canada. Brazil has worked very hard to control and eradicate ND, but it is surrounded by countries that do not, “so their industry is in the same situation as ours,” Glisson says.

Brazil has developed a “national poultry health plan, targeted to major diseases of economic interest,” says Rui Eduardo Vargas Saldanha, vice president and technical director of the Brazilian Association of Animal Protein (ABPA).

## The challenge of antibiotic-free production

There is increasing consumer pressure to produce chicken and eggs raised without antibiotics (also referred to as antibiotic-free or ABF) in mature markets. In fact, many restaurant, hotel and supermarket chains have stated that they will only buy chicken and turkey from farms that have never been treated with antibiotics.

What is concerning about this, Glisson says, is that “it is not the government that says this, but retailers.”

Ionophores, a major group of coccidiostats used to control coccidiosis and necrotic enteritis, are antibiotics. This creates a major challenge in ABF production.



## THE FUTURE OF POULTRY HEALTH: NEW AND OLD CHALLENGES

The other major problem in ABF production is respiratory diseases that turn more complicated with colibacillosis. It is expected that more airsacculitis problems will arise.

“Producers will have to learn new ways to produce in the context of the decreased use of antibiotics with more focus on prevention,” says Jérôme Baudon, Head of Strategic Business Unit Avian at Boehringer Ingelheim Animal Health.

In this regard, Ceva’s Comte says that “we have some

### Movement toward a universal vaccine

For the Brazilian Association of Animal Protein’s Rui Saldanha, “most of the problems that compromise the poultry sector can be prevented with biosecurity.”

That’s why “the producer is in the process of going from treatment to prevention, with a focus on vaccination,” says Merial’s Jérôme Baudon.

Prevention is the key. Therefore, Ceva’s Sylvain Comte also agrees that “we are going toward vaccination and management, and less direct treatment.”

Consequently, the industry will look to “develop a mix of technology, with vector vaccines and classic live vaccines,” but also “there will be new vaccination programs, new ways of doing and adapting them.”

Another aspect of this concept is the universal, “all-in-one” poultry vaccine.

“Poultry producers are asking us for a single vaccine with multiple viruses or antigens – a single-application vaccine,” says Baudon.

In the future, vaccination will move from the farm to the hatchery. To do this, technology is needed to ensure proper application through process automation in the hatchery.

vaccination solutions, but 50 percent of the job is to work with the producer in monitoring field data, management, and the environmental and husbandry conditions.”

### Problems with cage-free production

The conversion to cage-free egg production has brought back some disease issues not seen in decades. Access to the outdoors can cause other health issues.

The problem for poultry producers is that many consumers “visualize production with birds that have access to the outdoors and the countryside, which certainly is not good either for bird health or controlling simple diseases, such as external parasites and coccidiosis,” Glisson says.

This will change the way producers develop health programs, because of increased risks. Cage-free birds have greater exposure to feces, and birds with outdoor access have greater risk of exposure to wild birds, rodents and other potential disease carriers and predators.

Activist groups that have driven these changes place more importance on allowing birds to perform natural behaviors than on other considerations like bird health.

“Much of the progress we have achieved, in which we have worked so hard on avian health, will be lost,” Glisson says.

### More poultry welfare considerations

There are several poultry welfare concerns being raised by activists, such as housing density, beak trimming and disposal of male chicks. All need solutions.

“Although they are driven by developed markets,” Baudon says, “developing markets will have to comply with these changes, in the sense of globalization itself and trade.”

“What is very worrying is that radical groups have been very efficient,” Marquez says, in such a way that many have accepted alternative production systems. But it is also worrying that these are views that do not suit all realities.

“It’s a Frankenstein rising above us – the view and action of the rich countries – that the rest of the countries are following,” Marquez says. ■

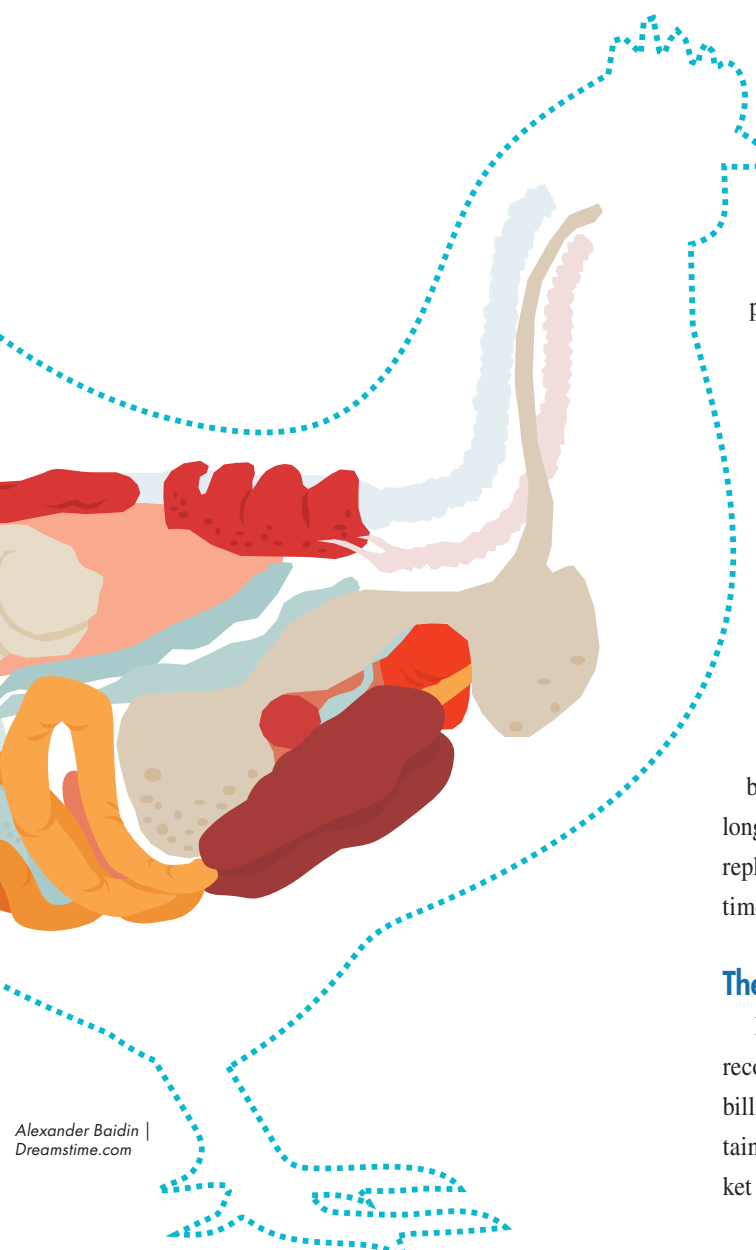


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# Gut health additives: four possible future scenarios

What does the future hold for the business of gut health additives during the next decade?

IOANNIS MAVROMICHALIS



“Antibiotics are dead. Long live gut health additives!” Indeed, this could very well summarize the prognosis by any health or nutrition professional when pressed for a quick answer about the future of gut health additives in the years to come. And, without giving it a second thought, they could be right, no? After all, antibiotics are being removed from an increasing number of feeds throughout the world, and we can all agree that at least these old compounds will not make a comeback — ever.

So gut health additives must continue taking their place, and what a great selection of additives we have. Even additives with no direct claims on antimicrobial activity try to benefit from this unexpected turn of events that saw long-established and inexpensive antibiotics being replaced by previously unheard of additives, at many times the cost and considerably less efficacy.

## The global additives business

In fact, the global additives business is growing at record speed, and it is estimated to exceed USD\$20 billion within a few years. Gut health additives certainly make up an increasing proportion of this market as other products, such as amino acids and flavors,



## GUT HEALTH ADDITIVES

appear to have reached maturity. Looking at this bigger picture, it is no wonder that new additives are introduced each year and old ones continue to enhance their claims. New companies also continue to emerge, trying to market new and old products to a shrinking clientele that is looking for immediate solutions now more than ever. After all, we still do not know how to replace antibiotics effectively, inexpensively and constantly; in other words, we have considerable room for improvement and growth.

If we were to consider the business of gut health additives for the next decade, we would have to ponder over all possibilities, even the most extreme. It is logical to assume that each scenario has its own proponents, especially when jobs and businesses are affected by the success or failure of all other possible scenarios. This remains a fluid market where all outcomes are possible. Here is what I believe could happen, in no particular order.

### 1 Nothing will change

Antibiotics will continue to be banned in even more countries, reaching a level where they will be considered virtually withdrawn from the global market. In contrast, the current trend to use the existing gut health additives will continue and even increase. New additives will find it harder to be registered and share a piece of this market. According to most professionals, this is the most likely scenario, at least for the foreseeable future. Based on this assumption, many new players are considering entering the market and others are expanding their portfolio, whereas only a few continue to investigate new additives.

The real danger in such an outcome comes from the consolidation in buyers and suppliers. A shrinking number of buyers (those who feed animals) will look to buy an increasing number of additives from a very small number of suppliers (manufacturers)

— hence the “supermarket” effect in which all suppliers will sell all additives up to the point that these additives will become commodities with low margins and standardized specifications. This will definitely benefit the buyers, but it will ensure the same fate to smaller additives suppliers as that experienced by most premix manufacturers: extinction.

### 2 A super additive will emerge

This is the dream of every researcher and additive supplier. It has happened before, and it can certainly happen again. Lamentably, this will also probably mean this new additive will enjoy a narrow window of success before being copied, regulated or replaced by other products. Being first is important, and additive suppliers acknowledge this fact by spending vast sums of money on research. Some will ask what is left to discover, especially after the sprint of research activity in the past 20 years, and perhaps they are right. Others point to the undisputable fact that new additives, even the best



**Read more online:** Good poultry gut health needs a broad approach,  
[www.WATTAgNet.com/articles/24181](http://www.WATTAgNet.com/articles/24181)

ones, will have to face a battle uphill, not only against fierce competition from other additives, but also from an increasingly difficult regulation framework.

Despite all of these difficulties, and if I were to make a bold prediction here, I would say any new super additive would no longer be feed-borne; I believe it will be something administered through the water, the next frontier in nutrition and health management.

### 3 Microbes will produce their own additives

It is surprising how many drugs and additives are produced today by microorganisms, such as bacteria and yeasts. What if these

same additives and drugs were to be produced in the gut by specifically designed microorganisms? Does the world of direct-fed microbials (probiotics) hold the key to our future?

## **MOST EXPERTS BELIEVE BUSINESS will continue as usual, but I disagree.**

- Ioannis Mavromichalis

This is at least something to discuss with probiotic suppliers. In fact, there are already products that claim antimicrobial action against *Salmonella*. They are based on yeasts and bacteria. Here the keyword is antimicrobial peptides, also known as “bacterial or yeast biological warfare.” There is still much work to be done, but the beginning is interesting and very promising. Questions remain, and the most important one is whether these antimicrobial peptides are similar to the very same antibiotics being banned. If yes, then I foresee a quick death to this technology, as we will be coming back to the original problem of enhancing bacterial resistance to human antibiotics. I do not believe this will be the case, but it is worth investigating before misinformation causes misregulation.

### **4 New drugs will emerge**

If we were a pharmaceutical company sitting on millions of research dollars and employing the best minds available, we would definitely not want to sit idle watching our antibiotic business being overtaken by gut health additives, especially now that they are still not 100 percent effective in replacing our banned antibiotics, right? But what could we do? Should we use our ample resources to find new molecules, new drugs that could be used in animals without causing resistance to human-level antibiotics? And while we do that, would it not pay to

launch a massive campaign to inform everyone about how harmless our new products will be and how inexpensive and effective they will be when used properly?

A dream, you say? Indeed, it is a dream that cannot be easily transformed into reality, and this is why most antibiotic suppliers are buying into gut health additives, trying to maintain their clientele and recover part of their business — but they will fail as this is not their core expertise. For a few visionaries, this is not a dream but rather a challenge. Indeed, some are already working hard to find these “nonantibiotic” drugs. Some preliminary signs indicate that the dream will materialize, but there is still no estimated time of “arrival.” Could this be the long-term solution to gut health management?

### **What to do in case of a disaster?**

As mentioned, most experts believe business will continue as usual, but I disagree. I believe we will see a new upheaval in the gut health business, most likely caused by probiotics or new drugs. In this scenario, most current gut health additives will become obsolete, and the change will be a rapid one.

To guard against such an unpleasant scenario, some additive suppliers are looking into what benefits their products have beyond the boundaries of gut health. Others try to create a niche for their class of additives by tying them up with a feed formulation matrix variable — an almost impossible task. Others work hard to make their additives so effective or multitasking that they become indispensable. All of them, however, are aware of the impending danger, and in their minds there is a pressing question: how to make their additive(s) as successful as phytase — something the computer picks up automatically. But even the successful enzyme phytase faces an uncertain future; what if phosphates become cheap again? Impossible, you say? Perhaps, as impossible as antibiotics coming back? We shall soon see. ■

# Future of poultry welfare: What producers can expect

Attitudes to poultry welfare still vary greatly from market to market, but ever-more alignment can be expected as interest in animal welfare grows.

MARK CLEMENTS

Poultry producers can expect welfare pressures to continue growing, probably at a greater pace than they have seen to date, necessitating ongoing changes to broiler and layer management.

Various welfare bodies emerged in the 19th century, growing in number in the 20th, but it has been in the 21st that interest has spread and intensified, and there are no signs that the pace of change will abate.

Welfare is a focus now not only of governments and interest groups but, increasingly, of multinational companies, and the latter will have ever-greater influence on the future of poultry welfare.

Even in societies where welfare is deemed a priority, a one-size-fits-all view remains on a far distant horizon, but the interest, and a follow-thy-neighbor approach, will see the world become ever more aligned.

For those that resist incorporating welfare demands, it is worth remembering that certain practices now standard in many markets, for example stunning pre-slaughter, were once novel.


## On the near horizon

Developed-world producers are already confronting a number of challenges that may eventually spread throughout developing markets, with commitments to phase out layer cages, perhaps the most high profile. The compromise solution in Europe implemented only a few years ago – furnished cages — is increasingly unacceptable, highlighting the pace of change.

For egg producers, this will not simply be new investment, but thoroughly reviewing flock management, and where welfare is concerned, views are mixed on benefits for birds.

Interest in slower-growing birds is a similar example of how welfare attitudes vary greatly between groups, as speed of growth alone is not universally seen as among the best welfare indicators. Nevertheless, welfare-motivated consumer demand in this area continues rising and the industry must respond.

Where beak trimming is concerned, banned in some countries and regions, its prohibition could become more commonplace. Abandoning the practice may require producers to offer birds greater stimulation and



**Free-range production is seen by many as being the most welfare friendly. However, opinion remains divided.**

Craig Holmes



alter feeding methods, and there are ongoing studies into how helping producers manage untrimmed birds. But rejection of trimming is unlikely to become universal.

According to Dr. Claire Weeks, senior research fellow in animal welfare at Bristol University's School of Veterinary Sciences, certain markets demand it, but it will remain niche in the short term.

And it may be the case that, as pressure on the practice increases, the need to beak trim diminishes. Changes at the genetic level may be the answer, as genetics companies look to develop birds less able to inflict harm.

A British Veterinary Poultry Association (BVPA) spokesperson explains: "Selective breeding has generated significant physical alterations, many of which would be regarded as welfare positive and void the need for mutilations."

### No longer an interest group preserve

The drivers of welfare are changing. Large corporations are taking a growing role not only in response to consumers, but picking up public sector responsibilities in countries favoring smaller government.

Where one major company leads, others follow. McDonald's 2015 announcement that all its eggs in the U.S. and Canada would come from cage-free birds was followed by others committing to do the same. This ripple effect continues.

Ignacio Blanco-Traba, senior global sustainable sourcing with McDonald's Corp., has said that McDonald's customers want to know more than ever how animals are reared and, being global, McDonald's applies its welfare policies worldwide.

Retailers will also put more demands on producers. It is Europe's retailers — not legislators — that are bringing an end to enriched cages.

Companies increasingly deem welfare a "key business issue," says Compassion in World Farming (CIWF). More are signing up to its Business Benchmark on Farm Animal Welfare (BBFAW) — established with World Animal Protection and Collier Capital — designed to drive higher welfare in food busi-



Jason Smalley

**Enriched cages, seen as addressing certain welfare concerns, were the choice of many European egg producers at the start of the decade. Consumer and supermarket pressures, however, mean that this option is already being rejected.**

ness. The latest BBFAW includes 99 companies.

It will not only be the poultry industry's clients that drive welfare, but its suppliers too. As the industry becomes increasingly standardized, genetics companies will have little interest in supplying birds that perform poorly in changed production system.

### Science or no science

The role of large corporations may be a mixed blessing. On one hand, they want suppliers to succeed, offering rules, sharing best practice and support. Private assurance schemes can be highly effective, but will only lead to genuine welfare improvements if properly designed.

Ultimately, consumer-facing food businesses will align with customers' perceptions. Despite good intentions, these perceptions may be neither good for bird welfare nor producers and, as the world becomes more interconnected, views are quickly shared across communities and geographies.

Dr. Weeks notes how social media has changed sourcing in the U.S. and how this is spreading: "Millennials are the ones on social media, and their ideas spread very quickly. But the people driving the agenda are ill-informed. The reality is wildly different to what consumers think."

## FUTURE OF POULTRY WELFARE

Yet alongside the consumer welfare interpretation, there is a growing body of scientific evidence and science-based recommendations that can help to improve poultry welfare in a measurable way. As this increases, it will become ever harder to simply dismiss all welfare demands as being part of an ill-informed animal rights agenda.

According to the Universities Federation for Animal Welfare: “Science informs, motivates and facilitates advances in animal welfare by providing a strong evidence base for changing attitudes and practices, and by creating practical and effective solutions to welfare problems.”

How welfare demands shape future poultry production will depend on who controls the agenda.

### Ever less a rich world concern

Welfare is often viewed as a developed world concern, unaffordable for the developing world. Yet as the developing world becomes richer, demanding more meat, its consumers will become more sophisticated. Once volumes are satisfied, consumers tend to move towards perceived quality.

But will the developing world be able to afford welfare standards with so many mouths to feed and priorities to meet?

The BVPA points out that, for much of the developing world, bigger issues for producers may include extremes of



**Global players, including BRF, are increasingly keen to emphasize their welfare credentials.**

According to the Food and Agriculture Organization (FAO), a lack of welfare legislation may be keeping producers out of international markets.

Yet change is occurring. Of the 99 companies in the latest BBFAW, 11 are from outside Europe, the U.S. and Canada, including from Brazil, China and Thailand. CIWF says that welfare allows companies to move up the value chain and enter new markets.

### Future barrier to trade?

As welfare develops piecemeal, there is a risk of more divergence. In practice, however, countries developing welfare codes tend to look to what others have already implemented, resulting in broadly similar standards. Looking longer term, however, the danger grows that welfare becomes a trade barrier.

**Tips for implementing broiler chicken welfare guidelines:** [www.WATTAgNet.com/articles/20668](http://www.WATTAgNet.com/articles/20668)

climate, natural predators and endemic diseases, and these may outweigh any welfare “benefits” from free range, for example. However, it also notes that it will be the expanding aspirational middle class with disposable income that will be likely to drive meat and egg production in some developing countries.

Standards that may appear to have little immediate local value may, in fact, offer poultry producers opportunities. Take, for example, Brazil, which, with only a small Muslim population, has become the world’s largest halal chicken exporter, responding to overseas demand.

Welfare trade disputes remain a long way off, but the World Trade Organization is paying attention to the area. In 2014, it rejected appealed EU ban on seal products, finding that non-trade concerns, such as welfare, can restrict trade.

That concerns are spreading cannot be denied. As Dr. Weeks points out, within Europe, welfare was a northern European issue, but is now Europe-wide and extending through trade deals. In Australia, 15 years ago, 10 percent of egg production was free range — it is now 50 percent. As consumers demand more welfare, producers must respond. ■



# Global food companies will control the poultry industry

The poultry industry’s future is big and global as growth slows in mature markets and opportunities are in multinational, food-protein ventures.

PAUL AHO

The world poultry industry is not immune to the titanic struggle for and against globalization as well as the unopposed disruption of the internet. It is safe to say that, in the not-too-distant future, all poultry businesses will be global internet businesses or they will not be in business at all. In addition, those global internet businesses will, in all likelihood, be food companies, not poultry companies.

### Why global companies will produce the poultry

Poultry companies located in the United States and Western Europe and even places like Brazil and Argentina must face the fact that their local markets are mature. The era of rapidly rising per-capita consumption is over in many countries. U.S. per-capita consumption of broiler meat, for example, rose from 10 pounds in

### World top grain exporters and importers, 2016



Assuming relatively free international trade in the future, there will tend to be less poultry production in grain-deficit areas and more poultry production in grain-surplus areas.



## GLOBAL FOOD COMPANIES WILL CONTROL THE POULTRY INDUSTRY

1950 to 80 pounds in 2000. No one should expect that U.S. broiler consumption will continue to rise at that rate. Consumption is now 90 pounds per capita and may never see 120 pounds per capita.

The slowdown in the growth of mature domestic markets will encourage poultry companies interested in growth to develop a global marketing and production strategy. The likely strategy is expected to involve a combination of strategic alliances and acquisitions in other countries. There have already been changes in the ownership of the U.S. chicken industry. JBS, a Brazilian company, purchased Pilgrim's of the U.S., which at the time was the largest U.S. chicken company. It can be expected that just like global automobile companies, global chicken companies will establish production in several countries and market in dozens of countries. They will be big companies; the appropriate scale of operation for surviving companies is likely to approach 1 billion chickens per year by 2030.

### Globalization and poultry competitiveness

Investment in new poultry production will increase in those countries that are the most competitive and decrease in those countries that are the least competitive. International competitiveness is not determined by performance because the technology of the world chicken industry is trending toward convergence using best industry practice. In other words, technology is readily accessible on a worldwide basis.

The important issues in international competitiveness are grain supply, labor cost and local government policies. Since feedstuffs represent the single largest cost of live poultry production, they represent a huge advantage to grain surplus areas and a problem for grain deficit areas. Low labor costs also provide a significant advantage. Grain exporting countries with low labor costs are in a sweet spot for poultry production if the local business climate is friendly.

Assuming relatively free international trade in the future (a big assumption), there will tend to be less poultry production in grain deficit areas and more poultry production in grain surplus areas. A concept that is likely to be cast aside is that of self-sufficiency. A more appropriate goal is optimiza-

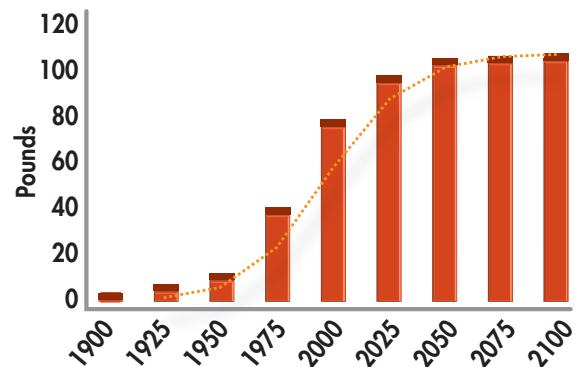
tion, which may lead to solutions such as being an importer and an exporter of poultry at the same time. Being neither an exporter nor an importer would be a highly unlikely optimization solution.

### Why internet poultry companies?

Leading poultry companies of the 21st century will need to not only use the internet but become internet

### Retail weight US per capita consumption of young chickens

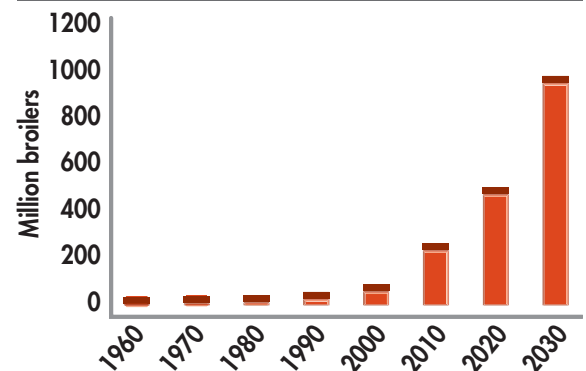
Source: Paul Aho



U.S. chicken consumption is now 90 pounds per capita and may never see 120 pounds per capita.

### Appropriate scale of operation for the world, million broilers per year

Source: Paul Aho



Looking forward 10 years, a firm that processes at least 1 billion chickens per year, half the size of Tyson Foods today, might be the minimum size for a global poultry company.

businesses. To become an internet business is to coordinate business relations with suppliers and customers in real time.

Web-based relationships may help create virtual integrations in countries without vertical integration and result in some disintegration in highly integrated industries.

The coordination of business relations could be described as the development of a three-way information partnership with suppliers and customers. The partnership is dedicated to creating value across a chain of production based on real-time market research and complex number crunching by powerful computers and optimization programs.

The development of web-based relationships may have some surprising effects on the world poultry industry. For example, in countries where the poultry industry is highly vertically integrated, the internet may act as an incentive for disintegration. It may create virtual integrations in countries without vertical integration.

### Poultry to be produced by food companies

If Tyson can be considered a bellwether for the future, the recent history of the company shows a company moving rapidly away from being a chicken company. First, it purchased significant assets in the processing of beef and pork, thereby becoming a protein company rather than a chicken company. This tactic is one adopted by other large multinational companies such as JBS in Brazil, the largest protein company in the world. JBS moved in the other direction from pork and beef into chicken.

Then, Tyson purchased Hillshire Brands for \$8 billion in 2014. That purchase moved the company in the direction of branded-protein packaged food and even further away from its origins as a chicken company. In effect, Tyson is becoming a food company.

Another intriguing aspect to the recent history of Tyson Foods is the increase in the amount of raw material chicken purchased outside the company. The hassle of live production appears to be not nearly as interesting as the marketing opportunities of further processed products

such as the ones brought on board through the acquisition of Hillshire.

### Horizontal integration in poultry's future?

This sets up the possibility that food companies of the future may engage in horizontal integration at the level of further processing and marketing and discard earlier stages of production. That would, of course, create a business opportunity for specialized firms to provide raw material to the food company in the form of live chickens or perhaps chickens that have gone through primary processing. An internet food company like Tyson could seamlessly coordinate with a new kind of company, an internet live production company, to create a virtual vertical integration.

As goes the broiler industry, so goes the turkey industry through the same development from small companies to giant firms and eventually becoming part of a larger food

### Who will supply China's growing appetite for poultry?

[www.WATTAgNet.com/articles/29835](http://www.WATTAgNet.com/articles/29835)

company. However, the consolidation into companies that produce several kinds of protein started earlier in the turkey industry than in the chicken industry.

For the moment, the table egg industry is the outlier in the headlong globalization of the poultry industry. Table egg production may be the last poultry industry to disappear into global internet food companies.

Food companies may engage in horizontal integration at the level of further processing and marketing and discard earlier stages of production. ■

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# Precision poultry nutrition shapes industry's future

Improved genetics will offer broiler producers growth opportunities, but technological developments will guide a holistic management approach

JACKIE ROEMBKE

The development of new precision nutrition technologies will increasingly generate efficiencies and profitability for poultry producers.

*orestligetka, fotolia*



Global food production must increase by more than 1 percent per year — nearly 70 percent in total — over the next 35 years. Forecasts suggest poultry will account for a sizable portion of the future food supply. In fact, production and consumption are predicted to double by 2050 — growth propelled by its low-cost, small environmental footprint, positive health attributes and lack of religious restrictions.

Such growth will be made possible by advances in genetics, management and nutrition.

“The future is extremely bright for poultry,” says Aidan Connolly, chief innovation officer with global ani-

mal health and nutrition company Alltech, who believes the poultry industry will soon achieve 1:1 feed conversion.

“Genetically, this should be possible by 2024, but there are many other factors that are preventing us from getting there,” Connolly explains. “If we see an improvement of a point, point and a half, in feed conversion every year, it could take 30 years; however, a 15-year time frame is possible if we really address underlying issues of precision nutrition from a gene expression perspective and disease management such as viral and coccidiosis control.”

First, it is crucial to identify what precision nutrition means for growers and how developing technologies will advance poultry production for maximum efficiency and profitability.

### Precision nutrition in action

Precision nutrition is defined as “the effective utilization of available feed resources with the aim of maximizing the animals’ response to nutrients” by meeting its precise nutritional requirements for optimum protein production.

“The precision nutrition concept is sustainable based on the minimum nutrient offer to the animals, achieving the right amount to respond to their potential genetics background,” said Mario Penz, Cargill poultry director. “To get the best results from nutrition, there are mandatory needs to be fulfilled, such as feed production quality, uniform diets, continuous pellet quality, farm biosecurity and healthy birds.”

While holistic feed and farm management isn’t new to poultry production, advancements in supporting technologies are fast-tracking opportunities for producers to better utilize the benefits of precision nutrition.

Here are several areas where precision nutrition will enhance feeding strategies:

### 1 The role of NIR analysis

Near-infrared spectroscopy (NIRS) equipment utilizes light wavelengths to analyze the nutrient composition of raw materials. NIRS measurements mitigate the economic losses of nutrient variability and allow poultry feed manufacturers to adjust formulations accordingly.

“Rapid sample analysis allows nutritionists to change their diet formulation, adjust ingredient safety margins, and monitor feed mill efficiency by correlating formulated diets to the actual diet nutrient value — minimizing over- and under-formulating diets and ensuring the birds receive adequate nutrition,” said Dr. Kendre Stringfellow, AB Vista’s North American technical and sales manager.

Precise NIR measurements are used in conjunction with available science-based nutrition data to enhance a producer’s feeding strategy.

### 2 New nutrient utilization

Advances in NIR technology have resulted in a larger number of analyzed nutrients and in the development of new nutrients, Cargill poultry technology director Henk Enting said, citing the development of the Amino Acid Index Database for protein-rich raw materials.

“Depending on the quality of the protein-rich raw material, the digestibility coefficients of amino acids are changed so we have a more precise prediction of the digestible amino acids in protein-rich raw materials,” he says. “These new nutrients have been validated by animal trials and result in a more precise formulation of our feeds. Also, fat quality can be analyzed more precisely by NIR by incorporating, for example, non-elutable matter.”

### 3 Feeding for genetics

Similarities in gene expression between the two primary genetics companies can be used as an advantage when it comes to the precise feeding of chickens or “the ability to feed specific genes and deliver nutrients to those genes at the right time and in the right form.”

“Today, we are fairly imprecise in how we feed nutrients — meaning diets are currently not determined by gene changes; they are determined by nutritional studies which are imprecise because we have great variability in respect to genetics, conditions and ingredients,” Connolly said, noting, for example, that feeding additives on exact days for an exact duration with the intent to make gene changes is the direction in which the industry is moving going forward.

“Changes in gene expression will be critical for fertility, productivity and immunity,” Connolly said.

## 4 Digestibility adjustments

Different conditions produce different nutritional requirements in chickens. In time, companies will be better equipped to adjust their feed formulations to the circumstances.

For example, Penz states, “A connection with more NIR analyses in excreta — where changes in the spectra can be related to changes in digestion — during the grow-out period, feeds can be adjusted to reduce the amount of undigested nutrients. This can help to improve both performance under challenging conditions and to improve litter quality at the same time.”

## 5 Raw material rankings

Going beyond the digestibility of nutrients, Penz feels the post-absorptive processes that rank raw materials based on digestibility coefficients will garner more attention.

As more is known about feeding bird microflora, its link to improved absorption processes and the regulation of immune responses at the intestinal level, it will spur further changes in the ranking of raw materials for poultry feeds, he says.

## 6 Business-to-consumer traceability

BIOMIN's development director Franz Waxenecker said precision nutrition systems will introduce semi- or fully automated traceability to the consumer. For example, ingredient or feed additive information could be captured and carried throughout broiler production and processing to the grocery store.

## Technological advancements

In the future, digital technology, automation and artificial intelligence are expected to revolutionize how chickens are fed and raised.

“At the moment, we are imprecise in our understand-

ing of what happens on a day-to-day basis in the chicken house,” Connolly said. “We estimate environmental conditions, litter conditions, nutrition. We don't know the variation that occurs on a bird-by-bird basis. We don't know a bird's real-time data — weight, feed consumption, water consumption. ... But I believe sensors will be a big part of things moving forward.”

Waxenecker agrees, “The sensors deployed in a precision nutrition system will provide additional eyes and ears to farm managers and technicians.”

In his opinion, the lack of connectivity between various systems, e.g. ventilation, feeding and health monitoring,

**Read: Expansion of Asian egg production remarkable and dynamic,**

[www.WATTAgNet.com/articles/6985](http://www.WATTAgNet.com/articles/6985)

causes data to be lost or underutilized.

The “Farm 4.0” concept — or the utilization of digital technologies for data capture — in precision agriculture programs form the basis of this model.

“With Farm 4.0, artificial intelligence should support the farm manager in decision-making,” Waxenecker says. “In the future, we see high-tech sensors being deployed throughout production to monitor feed, feces, barn air, animal behavior and more. Sensors connected to significant computing power would use deep learning algorithms to correlate monitored inputs with potential underlying issues to identify arising problems and suggest or even take corrective action as needed.”

Real-time adaptations will also be made using “machine vision” technology, or the use of smart cameras, to observe bird behavior to monitor what is actually happening in the house, Connolly predicts. ■

*References available upon request.*





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## Future of poultry processing: Intelligent automation

With increasing sensor capabilities and falling costs for computing power, practical systems are being developed that promise to fully automate tasks as varied as breast deboning and carcass inspection.

TERRENCE O'KEEFE

Equipment companies have successfully automated virtually every task in first processing in modern broiler processing plants. People are still required to hang the live birds, inspect/trim carcasses, conduct quality tests and adjust equipment, but eviscerating departments that used to require 100 or more workers now may need fewer than 20. Many carcass cut-up and dark meat deboning

operations have experienced similar levels of automation, but automation of breast deboning has proven to be more difficult.

### Automation versus cone line

Early attempts to automate breast deboning in broiler and turkey processing plants were largely unsuccessful,



## FUTURE OF POULTRY PROCESSING: INTELLIGENT AUTOMATION

because labor cost savings in the actual steps to remove the breast meat from the breast frame were often more than offset by the cost of decreased breast meat yield and increased labor cost for trimming and inspecting the meat. This general tradeoff of reduced total meat value versus labor cost savings has remained relatively intact for three decades, but automated systems have improved.

Equipment offerings have been getting more effective at removing meat and minimizing bone breakage, and labor costs have continued to increase. In the European market, where bird sizes are smaller and the labor cost per pound of meat processed is higher, automated breast deboning systems have become widely accepted by broiler processors.

In the U.S., where the live weight of birds raised specifically for deboning routinely exceed 9 pounds (4.1 kilograms) the cost analysis has still generally favored deboning of breast frames on manual cone lines. The statement, “a good cone deboning line can outperform a machine” is still generally accepted, but things are changing.

### Intelligent automation

“Yield has been the primary driver in the North American market (for breast deboning). If labor (cost) becomes a primary driver, we will see more automated deboning systems in North America,” said Dr. Doug Britton, program manager, Agricultural Technology Research Program, Georgia Tech Research Institute.

Britton, who heads up a research group that has developed an intelligent breast deboning system, said: “I expect that in the next five to 10 years, we will see intelligent solutions that allow these deboning systems to accommodate both bigger and smaller birds which will match the yield performance of human operators and achieve the line speeds that make them tractable

as fully automated solutions for doing breast deboning. There is no doubt that this is coming down the pike.”

This optimism regarding the future of intelligent breast deboning is the result of a couple of developments. Britton said the cost of robots has dropped significantly, by about half over the past five to 10 years. This is indicative of the drop in the cost of the sensors and computing power needed to operate machinery that can adjust itself on the fly. Another significant factor in

### Learn more about intelligent breast deboning:

<https://goo.gl/5uyRbG>

<https://marel.com/amf-i>

the equation will be the increasing cost of labor.

When considering the true cost of labor on a deboning line, much more than just the cost of wages and average benefits for workers need to be considered, according to Britton. Workers compensation costs specific for deboning line employees need to be considered as well as the downtime costs when there are labor shortages.

Britton pointed out that in systems that require manual adjustments, the adjustments tend to be made after the size change and reaction to a problem. With truly self-adjusting systems, the adjustment is made for each breast frame, just as trained workers would do on a cone line.

### Intelligent breast deboning

The technologies developed by Georgia Tech for intelligent broiler breast deboning have been tested at about 33 to 50 percent of the line speed anticipated in a processing plant, according to Britton. He said the technology and intellectual property for the system are now available for license, and because of this he couldn't describe the system for this publication. He

said there have been improvements made since information was last released about their work.

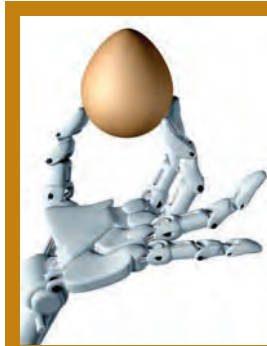
WATT Global Media contacted several equipment companies to ask about the future of intelligent deboning systems. Arie Tulp, sales and marketing director, Marel Poultry, said the company's AMF-I breast deboning system automatically detects the size of the breast cap and adjusts.

"This intelligent solution automatically adapts its settings to the individual incoming products, eliminating the need of pregrading," Tulp said.

## Integrated systems

Britton and Tulp both said an effective intelligent deboning system is a combination of the right sensors, software and mechanical equipment. Tulp explained that simple sensors all the way up to complex image-capturing ones, such as X-ray or video, are already being used in equipment. He said more ways to translate sensor information into mechanical actions, such as servo action, pneumatics and hydraulics, are being implemented.

Tulp said the key is probably in the algorithms that allow translation of the sensor data about the breast cap to be deboned into effective action by the equipment. One way of looking at this process is that the sensors function like the vision and sense of touch of the human deboner. The deboning equipment takes



*bigstockphoto.com | paul fleet*

**Robotics in poultry processing – a growing role?**  
[www.WATTAgNet.com/articles/24517](http://www.WATTAgNet.com/articles/24517)

over the role of the knife and muscles, and the software and computer take over the role of the brain and experience.

## Automated inspection systems

Vision systems

that can inspect and grade carcasses prechill and post-chill have successfully been developed and employed. X-ray bone inspection systems that can find bone fragments that aren't visible on the surface of the meat are also available. One of the next steps is for development of systems that can detect a wide range of foreign materials. Expect all of these systems to become more accurate and reliable in the future.

## Water's role in processing

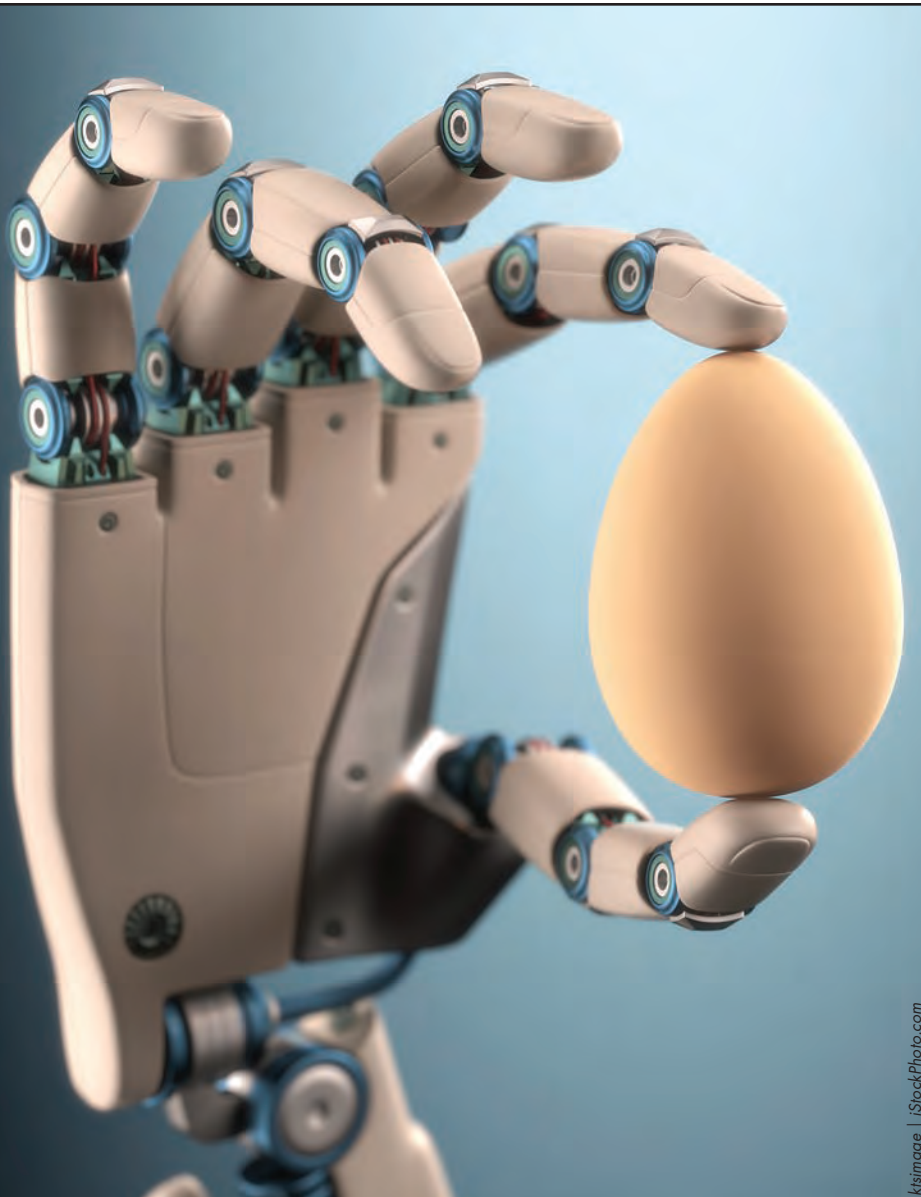
The cost of treating water continues to go up and, in some parts of the country, poultry processors are in competition with other uses for water. Britton said the combination of increased water treatment costs and water scarcity may ultimately have an impact on how liberally water is used in poultry processing plants.

Britton suggested that air chilling of poultry carcasses might gain broader acceptance in the U.S. as a result of these water issues. He said his research group is investigating several water-saving and reuse technologies. They are even investigating use of alternative chilling media like ice slurries. ■

# Future of egg processing: **Intelligent automation**

With falling costs for sensors and computing power, more practical systems are being developed that promise to fully automate more egg processing tasks.

TERRENCE O'KEEFE



Relative to processing poultry carcasses, processing eggs has been easy to automate. When it comes to washing, inspecting, grading and packing shell eggs at an inline facility, the vast majority of the eggs can make it from the hen to the egg carton without being touched by a human. It is expected that automation will move into even more areas of egg processing in the not-so-distant future.

## **Expect increased use of robots**

Robots will be used for more activities in egg processing and packing plants in the future. This optimism regarding the future of intelligent breast deboning is the result of a couple of developments. Dr. Doug Britton, program manager, Agricultural Technology Research Program, Georgia Tech Research Institute, said the cost of robots has dropped significantly, by about half over the past five to 10 years. This is indicative of the drop in the cost of the sensors and computing power needed to operate machinery

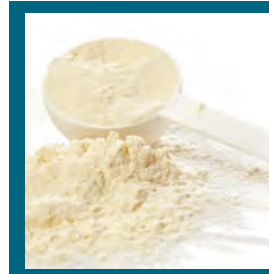
that can adjust itself on the fly.

Robots for packing egg cartons into case boxes and others for stacking cases on pallets will be more widely adopted in egg packing plants. Another significant factor in the equation will be the increasing cost of labor as well as the difficulty of staffing weekend and holiday shifts.

Michael Strange Midskov, CEO, Sanovo Technology Group, said: “The increased demands for better physical working environment and working roles will also be catalysts for automation. At the same time, it will be more and more difficult to hire people in for physically hard jobs to ensure the production.”

### Different set of skills needed

With increased automation and more sophisticated machinery, egg processors will face a different staffing challenge. Midskov said: “The challenge in the future will be to



**Read:** Rembrandt Foods sees opportunity in protein powder market, [www.WATTAgNet.com/articles/28509](http://www.WATTAgNet.com/articles/28509)

Blackley/Dreamstime.com

hire the right skilled employees into the new ‘industry’ who can operate a fully automated egg processing plant, where the focus will be on increased demands for food production, food safety, continually increased demand for new products, increased flexibility in production, logistics and the handling of packaging and distribution with high-technology machines, robots and equipment.”

Automation and robots may also play a role in food safety in the future. Midskov said egg processors will focus more on traceability, clean label eggs, increased cleaning and hygiene in the production, and a

production setup in the future.

He said that doing this with as few people in the processing area as possible will help prevent product contamination.

Midskov said: “Employees will be replaced by robots and full automation solutions to avoid contamina-

tion from humans. There will be increased requirements for the use of materials in the machinery and equipment to be food approved and which will ensure increased hygiene.” In addition to the increased automation, the equipment will be designed to be clean in place (CIP).

### Economies of scale versus geographic dispersal

The avian influenza outbreaks around the world, particularly in Europe and North America, have called into question the tradeoffs between farm size and disease risk. Automated equipment that can wash, inspect, grade and pack greater volumes of eggs per hour has been one of the economic drivers for farms with greater hen numbers.

Producing eggs on a greater number of smaller farms that are geographically dispersed would seem to reduce the risk of an outbreak taking out all of an egg company’s hens, as long as each of the farms grades and packs its own eggs. Reduced costs for smaller versions of automated equipment would help to make geographic dispersal of hens more economical. ■



Austin Alonzo

**Robot arms, like this one loading pallets, represent the industry’s movement to increase efficiency, reduce the need for labor, and process ever more eggs.**

# Sustainable poultry production driving industry advances

Poultry producers, already leading in some areas of environmental sustainability, will face growing pressure to minimize their impact as demand for meat continues and eggs intensifies

MARK CLEMENTS

Pressure on the poultry industry to be more environmentally sustainable can only grow as concerns for the environment and demands for transparency increase.

As broiler and egg producers face growing demand for animal protein, how the industry responds will vary, as definitions of sustainability vary from country to country and company to company.

There is no universal definition of sustainability and, even where there is consensus, definitions have evolved since first emerging in the 1960s.

Sustainable production in its broadest sense interlinks three dimensions – environmental, social and economic, and companies and policymakers have placed varying emphases on each of these strands.

Yet where environmental sustainability is concerned, there is now general recognition

**Larger, modern and more technologically advanced farms are often more environmentally sustainable than more traditional methods, despite public perceptions.**

Source: Hydor Ltd.

On farm or off, poultry producers may need to become energy producers. Once complete, this Northern Ireland anaerobic digestion plant will generate 3MW of electricity from up to 40,000 tonnes of litter annually, and will help to resolve local nutrient run-off issues, says developer Stream BioEnergy.

Courtesy Stream BioEnergy

that the earth's resources are limited, and that the environment underpins economic and societal development.

Within the poultry industry, many companies have already made significant progress in reducing environmental footprints and greening their businesses. However, as demand for animal protein increases, reducing or stabilizing environmental impacts will become more important but harder to achieve, meaning that even businesses with advanced sustainability policies will need to constantly review them.

## Sustainable birds

Poultry genetics businesses have made significant progress in developing birds that make better use of the resources expended on them.

The modern broiler or layer is a very different bird from that of only a few decades ago, with better livability, improved growth and feed conversion rates, and higher yields, be it for meat or eggs. Put simply, genetics companies have been developing, although not solely focusing on, birds producing more with less, making them perhaps ideal examples of sustainability.

## However, the future may not be quite so straightforward.

Newer considerations have been influencing bird development, including welfare, a growing preference for slower-growing broilers, and cage-free environments for layers. This could be viewed as less than optimal from an environmental sustainability point of view, given additional resource requirements.

Yet, selection programs have taken these demands into consideration, and birds able to respond to newer rearing practices have emerged. For producers, however, these demands for more space, or for keeping birds longer, may drag on environmental sustainability efforts.

A broader approach in genetic selection can be expected to continue, but there may be other limiting factors in making birds more sustainable -- the physiological limits of birds themselves.

## Nutrition and feed

Continued progress will also occur in nutrition, both

from the perspective of bird genetics and from a deeper understanding of nutrition itself.

As technology develops, it may be possible to include ingredients in diets that, to date, have not proved feasible or economical, and that can be locally sourced. Technological developments should allow nutrition to be better aligned over the entire growing or laying period.

Adriaan Smulders, strategic marketing and technology lead, poultry and additives EMEA, with Cargill, explains: "Precision nutrition/mineral efficiency brings better welfare for the birds and optimal use of raw material resources.

"A tailor-made diet will ensure that the animal can use the building blocks of the feed as efficiently as possible.

## Sustainability tips for the poultry, feed industries: [www.WATTAgNet.com/articles/26729](http://www.WATTAgNet.com/articles/26729)

This will lead to less loss of valuable nutrients. By feeding the birds what they need, less is wasted."

He continues that better nutrition can also mean healthier birds, less likely to be prone to disease. With better nutrition, more birds will grow optimally, survive and produce more protein.

The transport of feed or additives has an environmental impact, and the closer to home any sustainably produced ingredients can be sourced, the greater the likelihood of reducing environmental impact.

But transport emissions may be small compared with those from milling itself, and concentrating production in fewer, larger mills may be more efficient than relying on many smaller mills, and become more commonplace.

## Intelligent systems on-farm

As larger mills may be more sustainable for feed production, the same could be said for larger farms. Economies of scale can result in more efficient resource allocation and make the use of precision agriculture, and its necessary investment, more feasible.

Sophisticated house management systems, able to control environments and feed and optimize perfor



mance, require investment, possibly beyond small producers. Such systems not only regulate inputs but also alert producers to problems.

From increased biosecurity to robots that “live” among flocks, technology will increasingly be applied, optimizing performance, minimizing waste and losses and improving a farm’s environmental credentials.

Producers may have to cease seeing themselves simply as producers of food, and increasingly as producers of food and energy, as waste becomes a growing issue and the technology to process it improves and becomes cheaper. Several producers are already well advanced on this path and are net energy exporters.

Yet large-scale “industrial” farming can be rejected by consumers who often see sustainability as rooted in traditional farming methods, for example free-range egg production, with less technological input, and this may be a barrier that producers will have to overcome if they are to be truly environmentally sustainable.

### Addressing consumer attitudes

Consumer views on farming are not the only attitudes that poultry and egg producers may have to address as sustainability pressures grow: attitudes to food itself may need to change, requiring new consumer relationships.

Animal protein production tends to consume more resources than producing plant protein, and calls to reduce meat consumption in developed countries or to impose a meat tax to protect the planet have emerged.

While many would argue against such calls, the rationale becomes less unacceptable when taken in the context of food waste.

A study based on FAO data by climate change group Champions 12.3 found that in North America and Oceania, consumer food waste stands at 61 percent, while Europe scores 52 percent. A separate study in the U.K. found that chicken is the most wasted meat.

The poultry industry may be seen as the most sustain-

able of all land-based animal production, but if its output is wasted, there is no sustainability.

As part of any sustainability program, producers may have to engage consumers in new ways, perhaps encouraging consumption of all poultry meat – be it white or dark – reducing the need to ship product around the world and satisfying demand with local production.

Detailed sustainability reports are likely to become more common, but it may also be necessary to encourage consumers to live up to the standards they demand of the industry.

### From farm to fork

A superficial approach to sustainability may become unacceptable, particularly as requirements for transparency build and governments intervene, and there are examples where the poultry industry is already leading the way.

For example, JBS has been recognized by the Carbon Disclosure Project, a global disclosure system enabling measurement and management of environmental impacts, as a top five company in Latin America for water management and security in the Program Supply Chain. The company’s Sustainable Water Management Program in Brazilian facilities has been selected by the Getulio Vargas Foundation Sustainability Study Center as one of Brazil’s 10 most innovative corporate water management initiatives.

But sustainability is a journey, not a destination. 2 Sisters, for example, which is already carbon neutral and a net energy producer, published ongoing targets for its facilities and supply chains, scrutinizing farm to fork.

Andrew Edlin, 2 Sisters sustainability director, says: “Having a plan in place is only the start. To be really effective, we know that our people, customers and partners have to understand what we are trying to do and why, and be engaged in working with us to meet these goals.

“To ensure we are working towards the right visions and targets, the entire Feeding the Future program will be reviewed at least every two years by a cross-sectional group of people from business and third parties as appropriate.” ■





100 YEARS  
WATT GLOBAL MEDIA

# A glimpse into the future of modern poultry production

Precise nutrition, robotics and the fact that society will force poultry husbandry to go in a different direction will change the face of poultry production.

BENJAMÍN RUIZ

Animal husbandry is defined in many ways, but basically, it is the science that deals with the production and care of farm animals, including nutrition, genetics and breeding, housing, handling facilities and techniques, hygiene, sanitation, health maintenance and disease prevention. In the future, poultry husbandry will ultimately go in a direction that will change the face of poultry production. Poultry industry professionals from around the globe share their insights on how new technologies and societal pressures will affect how poultry is produced.

“Nothing will be the same in poultry husbandry in the upcoming twenty years,” said Dr. Mário Penz, key accounts director for Cargill Animal Nutrition, in a simple but rather clever statement used as a benchmark in this article.

In the last 50 years, the poultry industry has been driven primarily by feed conversion and production costs. In contrast, animal rights, environmental and social issues will play a much larger role in future production decisions. “Will the idea that ‘chicken is chicken’ continue to hold true?” asked Zur Fabian, vice president, Diversified Imports. Maybe not, considering there are consumers willing to pay a premium for poultry raised according to specific animal care and environmental standards.

## Nutrition in real time

From a nutrition perspective, “The main task will be more than simply pushing for better performance,” said Luca Vandi, regional marketing officer at Biomim. Precise nutrition and nutrient evaluation with real-time data will all play a role.

“Precision nutrition promises to shift the role of feed additives to some degree,” said Vandi. But rather than pushing for a better performance, “It will entail creating the optimal diet to minimize gut stress and maintain a balanced, diversified gut microbiota. There is already increasing awareness that feeding an animal means feeding a microbiota,” he continued.

We can expect to see in the future a greater focus on evaluating ingredients to see what impact they will have on the gut microbiota.

## Water in the sights

Water, often the neglected nutrient, will play a major role in the next few decades. “In my opinion,” said Vandi, “water will be the main limiting factor for the poultry industry’s growth.”

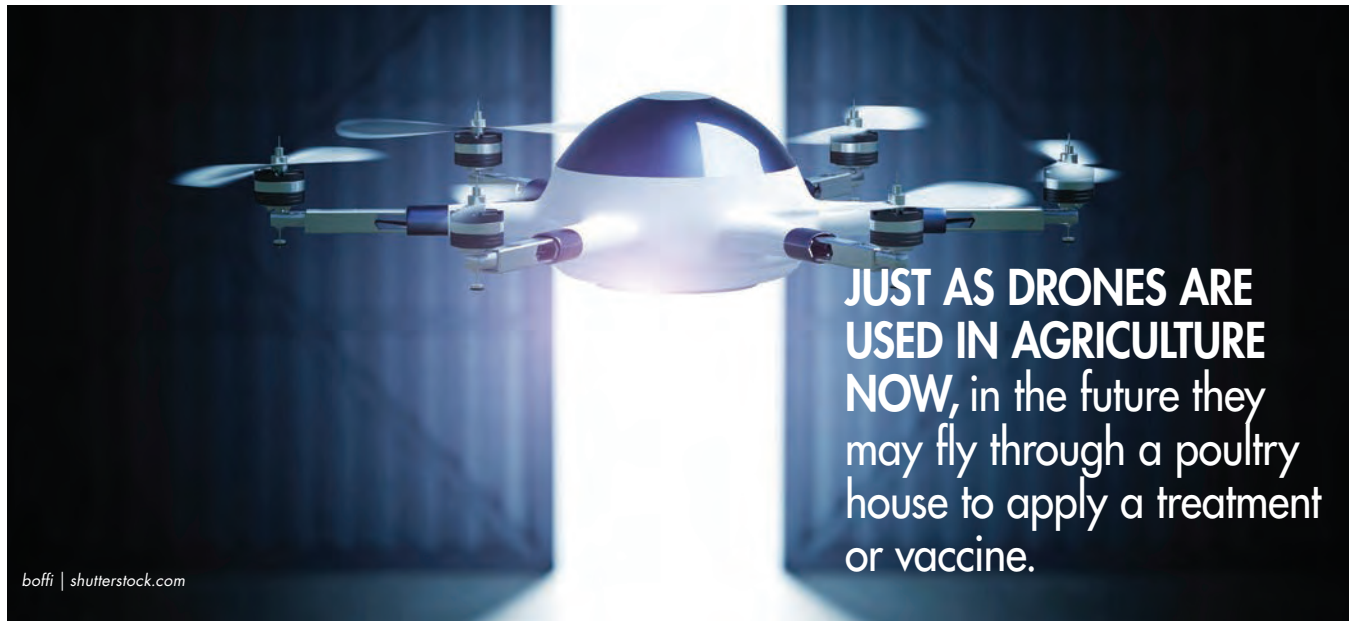
Even with the best feed formulation, an animal will not be of much use without adequate drinking water. Therefore, technologies that optimize water usage and supply will need to be developed, such as UV light. “Water quality will be monitored and provided on a daily basis,” said Chris LaPak, sales manager, Americas, Chore-



**Read more:** The future of poultry health: New and old challenges,  
[www.WATTAgNet.com/articles/29615](http://www.WATTAgNet.com/articles/29615)



## MODERN POULTRY PRODUCTION



**JUST AS DRONES ARE USED IN AGRICULTURE NOW, in the future they may fly through a poultry house to apply a treatment or vaccine.**

boffi | shutterstock.com

Time. Also, “Water requirements [for farm animals] will be raised to that of human quality drinking water,” said Fabian.

### I, chicken robot

Although it might appear like a dystopian science fiction movie, “No doubt robotics will be all across the poultry business,” assured Penz. It is likely that the main issue will be efficiency. “Automation and mechanization will be essential to permit cost effective, controlled, repeatable and reliable production,” emphasized Jassen Jackman, sales manager at Vencomatic. “Artificial intelligence could interpret animal behavior in real-time, signal where intervention is needed and order the unit/equipment to carry it out.”

There will be further automation of feeder lines, allowing proper access and levels, plus automated height adjustments. Automation of drinker line pressures and consumption will be graphed to show hourly bird consumption. “Future feeders and drinkers, as well as supplements, may be administered in a ration manner, where birds that have eaten will no longer have access to feed,” added LaPak.

Replacing wires with wireless or Bluetooth will be a means to reduce installation, labor and maintenance costs, explained Fabian. There is also potential in alternative

concepts like heated floors, which would enable smarter energy use while maintaining ideal floor temperature for dry litter with less ammonia. On climate control systems, LaPak said that they will continue to be automatic.

Robotics will also be more utilized for bird harvesting and mortality disposal. But all this “will have to become far more animal welfare-oriented,” said Michel De Clercq, managing director of Petersime.

### Drones, videos, microchips and biosecurity

Any tool that decreases manual intervention has plenty of potential for the industry. For instance, “Drones may fly through a house to apply a treatment or vaccine,” highlighted Vandi, or “Video monitoring of bird activity will probably be required to exhibit bird health and potential house equipment issues,” added LaPak. Managing birds and making decisions from a distance will be the rule. Drones can also be used to stimulate birds and retrieve mortalities. And cameras, in combination with heat and motion sensors, can alert producers on the movement and condition of birds.

But this can go further: the use of small microchips in birds to monitor bird health. LaPak thinks that data acquisition could be made accessible to the public, and clear indications of producers may be made available to

consumers, much like what is done with eggs. Data acquisition software could also identify and remove any birds that are considered unhealthy or contagious.

Extreme biosecurity measures will likely be observed and followed, and human access will be very limited, meaning improved biosecurity. Less contact with chickens contributes to the further reduction of antibiotic use, matching the demand for antibiotic-free products.

### Alternative energy resources

Increasing efficiencies should be a focus as well as a smart system to use natural resources. “Alternative energy sources will play a vital role in helping us meet the demands of production while focusing on sustainability. Wind and solar power, and rainwater harvesting can offer sustainable solutions, while also helping with our public reputation as a mass consumer of resources,” said Fabian.

### Purpose-built equipment

The strong anthropomorphic attitude of society toward animals is having a strong influence in poultry husbandry and production. In conjunction with this, Penz thinks that society will force egg production to go in a direction that is not fully proven to be the best to the hens. On the other hand, this new driving force is pushing for changes in equipment, like improved cage-free design, which is rendering progress. “We are already reducing things like floor eggs or keel bone damage,” said Jackman.

It is important to point out that, while entering this new wave of cage-free production, purpose-built equipment must be applied. New housing system designs must allow for an increased barn space utilization, without compromising stocking density for meat and egg production.

### In ovo sexing and on-farm hatching

Something that would change the entire system in the near future is on-farm hatching of broiler chicks. “Hatcheries can be expected to be significantly larger than today’s and more automated, with eggs moved automatically throughout



**IN THE FUTURE,  
WATER WILL BE SCARCE, BUT  
THE WATER QUALITY FOR FARM  
ANIMALS WILL BE RAISED TO  
THAT OF HUMAN QUALITY  
DRINKING WATER.**

science photo | Shutterstock

the different areas,” said De Clercq. But there is also “the possibility of keeping chicks at the hatchery until days 3 to 7 to help them get stronger before placement,” added Fabian.

Along with automation, advances in hatchery technology will make it feasible “to have better hairline crack detection and perhaps even accurate sexing of birds *in ovo* and better hatchability,” said Jackman. Along with *in ovo* sexing, “Vaccination and administration of additives will be common place,” said De Clercq. Other advances include embryos of the unwanted gender not being hatched and incubation performance improving due to individual egg/embryo monitoring.

### Antibiotic-free production, husbandry

The good old concepts of biosecurity, feed quality and management will be more mandatory now than ever. Caged production egg systems have been helpful to isolate animals, in a way, from pathogens. The poultry industry will need mechanisms for controlling these pathogens and disease, if isolation is no longer permitted.

Slow-growing birds and antibiotic-free feed will require closer monitoring of bird health, since birds will be in the houses longer, and the industry will likely need to find organic alternatives to treat birds. Much work is being done on that today, but the demand that the poultry industry will face will probably require looking at synthetic replacements. ■



# Poultry, aquaculture set to dominate protein markets

Aquaculture and poultry are winning the competitive battle for share of the global farmed animal protein market.

THOMAS ELAM

There are major differences in competitiveness among the diverse species that make up the global animal protein supply. The winners in this competitive battle are the species that are highly desired by consumers and efficient to produce.

Global protein production trends clearly show who is winning and who is falling behind. If 1990-2014

growth rates persist, chicken will overtake pork as the No. 1 meat by about 2020. In the not-too-distant future aquaculture could overtake chicken.

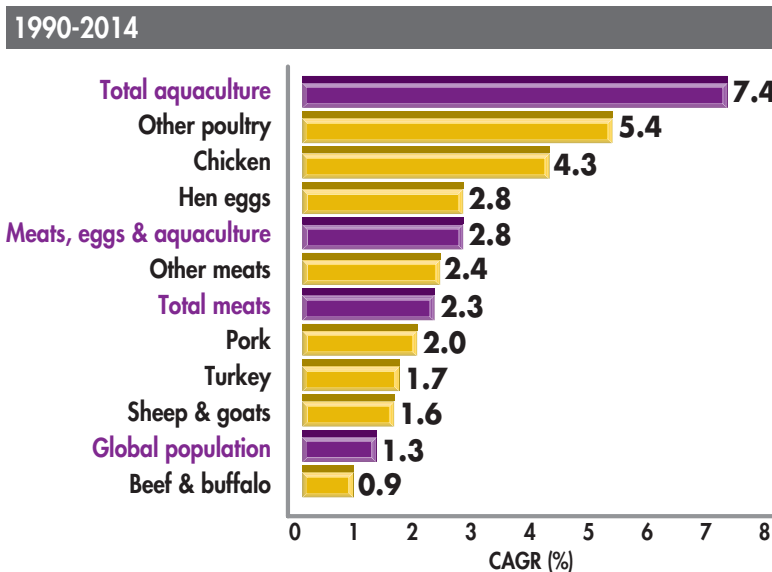
## Dramatic differences in growth rates among proteins

Within total protein supply, ability to compete is revealed by production

trends. The fastest growing species are those that are suitable for large scale production and the most feed efficient. (See Figure 1)

Figure 1 contains 1990 through 2014 Compound Annual Growth Rates (CAGR) history for the major meats, eggs, aquaculture (farmed fish and shrimp), several minor meat categories, plus global population. The items are sorted from fastest to slowest growth rate. The only item growing slower than population is beef and buffalo. The clear majority of that category is beef. Total meat, egg and aquaculture production is growing 1.5 percentage points faster than population, indicating a 1.5 percent annual global per capita growth. Beef and buffalo production is growing much slower than global population, and average per capita consumption is shrinking.

## Compound annual growth rates, selected proteins



Source: Food and Agriculture Organization (FAO) FISHSTAT, FAO PROSTAT

**FIGURE 1: If growth rates persist, chicken could overtake pork as the most-consumed meat by about 2020.**

## Feed efficiency drives growth

Looking at the table's CAGR rankings, the higher ranked categories are generally the most feed-efficient protein producers, and lower ranked are less feed efficient. Feed



### There are major differences in competitiveness among the species that make up the global animal protein supply.

efficiency is related to production cost. A major exception is turkey, ranked near the CAGR bottom, but more feed efficient than pork.

Another important factor is consumer acceptance. The fastest growing species are almost universally acceptable. That would include all poultry products and fish. Beef and pork both face significant religious and cultural barriers that limit demand in some parts of the world. Despite excellent feed efficiency, turkey meat has just never caught on outside North America and parts of Europe.

Ruminants rank very low on global growth rate despite being able to convert grass to meat. It has been argued that the ability to utilize grass that would otherwise not be used for food production is a ruminant competitive advantage. The downside for ruminants is that the requirement for grazing land also limits scale of operation - unless the animals are confined and fed compound feeds. Ruminants are not as efficient as monogastric animals in converting grains and oilseeds into meat. The result is that, in general, ruminants are not cost competitive with modern aquaculture, poultry and pig systems.



### Trend projections for proteins

Looking at long-term production trends, aquaculture and poultry are clearly winning the competitive battle for share of the global farmed animal protein market. The battle is almost entirely one-sided. Only pork is even close to keeping up. (See Figure 2)

Projections in the chart are based on the same 1990-2014 compound average growth rates contained in the table, not the entire FAO 1961-2014 dataset. This data subset is employed primarily due to the dramatic slowdown in beef and buffalo production growth that occurred in about 1980. Using pre-1980 data overestimates projected 2025 beef production.



Aquaculture here includes farmed fish and shrimp. Growth rates are more than triple pork, and five or more times that of ruminants. Those who have not looked at aquaculture recently may be surprised at its scale and growth rate. That may be because it is largely an Asian phenomenon, and within Asia heavily concentrated in China, India, Indonesia, and Vietnam. Asia accounts for about 88 percent of global category production.



## DOMINATE PROTEIN MARKETS

### How the proteins rank in rates of growth

While currently ahead of aquaculture in total production, chicken production is growing slower. Based on recent growth rates that are double pork, global chicken production will exceed pork by about 2020.

While much smaller than chicken, the other poultry category is growing slightly faster than chicken. The primary species are duck and geese, and the major producer is China.

Often overlooked, egg production (not including minor duck, goose and other poultry) is growing at the same rate as all proteins, faster than pork, but slower than chicken and aquaculture. Eggs are a favored food source in developing countries where costs are an important consideration.

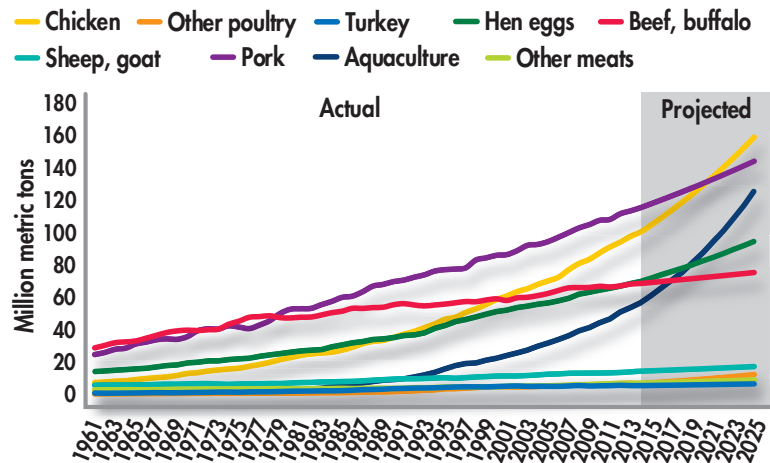
As a separate poultry item, turkey is the smallest of the categories and is the slowest growing. Outside of North America and parts of Europe, turkey has not gained a foothold in the protein market.

Pork has been the No. 1 meat in the global diet since the late 1970s. Traditionally China has accounted for close to half of global production. As Chinese population growth slowed, and incomes grew, pork production growth slowed. Part of that slower growth is due to the desire to diversify the diet. Rapid growth of Chinese aquaculture also put limits on pork production growth.

Beef production growth slowed dramatically in the 1970s. This slowdown coincided with the global adoption of

## Global farmed protein production

1961-2014 actual, 2015-2025 projected



Source: Food and Agriculture Organization (FAO) FISHSTAT, FAO PRODSTAT

**FIGURE 2: Long-term production trends show poultry and aquaculture holding much of the share of the global farmed animal protein market.**

the integrated poultry production model. Subsequently, pigs and aquaculture have also vertically integrated to varying degrees, further putting pressure on the more traditionally structured ruminant production systems.

The “other meats” category includes a wide variety of species that important in some areas, but are a small share of global supply. The overall growth rate is about the same as pork.

The other ruminants, sheep and goats, are also relatively small and growing slightly slower than turkey. This category’s growth is concentrated in the Middle East, where sheep and goat meat is preferred, and local small-scale production is relatively cost effective.

### Chicken and aquaculture making gains

Dramatic differences in global farmed meat production categories are a symptom of differences in produc-

tion efficiency and local preferences. The most efficient categories are winning share. Ruminant-based production systems will remain an important source of animal protein, but cannot match the more efficient systems that have been growing faster for decades.

Overall farmed animal protein production is increasing faster than the population. There are no apparent short-term barriers to prevent continued growth in global per capita farmed animal protein production. ■

*Thomas Elam, PhD, is president of FarmEcon LLC.*



# Will no-antibiotics-ever poultry improve human health?



Many U.S. broiler producers have switched to no-antibiotics-ever growing programs, but it is not certain that this will reduce antibiotic resistance found in pathogens in the poultry house. *Terrence O'Keefe*

The number of broiler, turkey and layer flocks raised in no-antibiotics-ever programs is rapidly increasing, but it is uncertain whether this will reduce antimicrobial resistance in human medicine.

## TERRENCE O'KEEFE

During the past five years, the number of broilers raised in the U.S. in no-antibiotics-ever programs has increased dramatically.

Grady Bishop, senior director, global market access, Elanco, told the audience at the Delmarva Poultry Industry Inc.'s National Meeting on Poultry Health, Processing and Live Production, Ocean City, Maryland, that the portion of U.S. broilers produced as no-antibiotics-ever birds has increased from just a few percent in 2012 to nearly 40 percent in 2017.

This rapid shift in how U.S. broilers are raised has come in response to purchase pledges by major quick-service restaurant chains like McDonald's and Chick-fil-A and as major poultry integrators, Tyson and Perdue in particular, have made antibiotic usage in their flocks part of their retail brands' marketing claims. This seismic shift in the marketplace, along with changes in the Veterinary Feed Directive, are also impacting how turkeys and table egg layers are being raised.

## WILL NO-ANTIBIOTICS-EVER POULTRY IMPROVE HUMAN HEALTH?

### The antimicrobial resistance problem

Human and veterinary medicine are facing a long-term challenge: Fewer new antibiotics are being developed while at the same time the incidence of pathogenic bacteria that are resistant to one or more antibiotics is increasing. Governments around the globe are trying to find ways to maintain the efficacy of existing antibiotics while encouraging the development of new antibiotics.

The One Health approach that has been adopted to combat antimicrobial resistance looks at antibiotic use in humans and food animals.

The marketplace now sees elimination of antibiotic use in poultry husbandry as a virtue, but will this change actually improve efficacy of antibiotics in human medicine?

### Will removal of antibiotics reduce resistance?

There haven't been a lot of studies looking specifically at the impact of no-antibiotics-ever growing programs for poultry on antimicrobial resistance of the microflora in the poultry house, according to Dr. Rolf Joerger, associate professor, department of animal and food sciences, University of Delaware. He said there has been some work done comparing antimicrobial resistance in bacteria on organic and conventional broiler farms. So far, he said, these studies have shown very little change in the level of antibiotic resistance in the pathogens.

"Right now, it is not completely clear if going to organic growing practices (which include no antibiotics ever) changes antimicrobial resistance in the short term, say within a few years," he said.

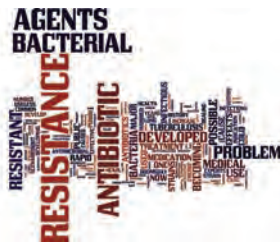
Joerger explained that many of these studies just look at pathogens, not at all of the microbiota. He said that if you just look at pathogens, there aren't that many of them, so your sample size is usually fairly small.

He said that if there will be a reduction in antimicrobial resistance in the poultry house that it may take years to develop, because the bacteria have been in the

poultry house for a long time, particularly with built-up litter systems. Joerger suggested that these bacteria may persist because they were adapted to that house environment.

Dr. Charles Hofacre, president, Southern Poultry Research Group, and professor emeritus, University of Georgia College of Veterinary Medicine, said the National Antimicrobial Resistance Monitoring Study (NARMS) provided funding for research looking at antimicrobial resistance in the microflora of *Salmonella* and *Campylobacter* found in broiler houses. Hofacre and Dr. Randall Singer, professor of epidemiology, department of veterinary and biomedical sciences, University of Minnesota, conducted the research, which continued after Hofacre's retirement from the university.

In this field study, environmental samples were collected by wearing a sock over disposable boots and walking in the poultry house. *Salmonella*



Read more about  
on-farm antibiotic use and  
antimicrobial resistance at:  
[www.WATTAgNet.com/articles/27560](http://www.WATTAgNet.com/articles/27560)



and *Campylobacter* were isolated and cultured from the samples and then were tested for antibiotic resistance according to the NARMS protocol. Birds raised in conventional and no-antibiotics-ever growing programs are included in the study, but the study commenced when no-antibiotics-ever growing programs were a small niche part of the industry. Results for the study have not been published yet.

### The problem of coselection and coresistance

Plasmids are small DNA circles outside the bacterial chromosome. Some bacteria can have plasmids that contain genes that provide resistance to more than one class of antibiotics or metals. Bacteria-carrying plasmids like this are called co-resistant. Coselection is the process where exposure to one antibiotic or metal selects for resistance to one gene in the plasmid and then also selects for all the other resistance genes that are in the plasmid.

Singer, speaking at the National Meeting on Poultry Health, Processing and Live Production, gave an example of how coselection complicates efforts to halt the increase in antimicrobial resistance. He said that one plasmid pulled out of *E. coli* found in a cow conveyed resistance to a number of antibiotics as well as some metals like copper and zinc. Copper and zinc are sometimes used in no-antibiotics-ever growing programs to help regulate gut microflora, but if a plasmid containing genes for resistance to the metals and antibiotics were present on the farm, then we might not be improving resistance like we think we are.

Hofacre said resistance genes to quaternary ammonia disinfectants has been found in plasmids containing antibiotic-resistant genes, so how the farm or hatchery is cleaned could theoretically affect resistance to antibiotics.

### Antibiotic resistance is a natural process

Just as the original antibiotics used in medicine were first found in nature, antibiotic resistance has evolved over millions of years in just about every environment on earth. We will never get to a zero level of antibiotic resistance. It evolved naturally long before humans harnessed antibiotics.

Joerger said the question is whether we can get back to what would be considered the natural or basal level of antimicrobial resistance in the bacteria in the bird's environment. He said no one really knows what the basal level of resistance really would be, but he said that it definitely wouldn't be as high as what we see on poultry farms today.

### Competitive exclusion and probiotics

Many successful no-antibiotics-ever husbandry programs for broilers, turkeys and laying hens utilize probiotics added to the feed to maintain healthy flocks with good performance. Hofacre said that a microorganism selected for inclusion as a probiotic because it helps keep *Clostridia* from colonizing the gut may not help prevent *Salmonella* colonization. In the future, Hofacre said probiotic cultures containing more than one serovar of microorganism could be used to accomplish multiple objectives, like preventing colonization with *Salmonella* and improving bird health.

Probiotics could contribute to food safety by aiding the production of poultry products with reduced need for antibiotics, which could reduce selection pressure for antibiotic resistance in the poultry house. Probiotics could also help prevent colonization of the digestive system with *Salmonella* and *Campylobacter*, which should mean less of a pathogen load on ready-to-cook poultry products. ■

# 12 people who transformed US poultry production

Chicken went from rare and expensive to bountiful and low-priced meat protein thanks to a host of innovators, including these 12 trailblazers.



## PAUL AHO

One hundred years ago, as the first WATT issue of Poultry Tribune was about to be published, nearly half of all Americans worked in farming and most farmers owned poultry of some kind. The crowing of roosters woke the nation every morning. Today, only 2 percent of Americans work on the farm and only a small fraction of those people raise poultry.

In the last 100 years, broiler chicken meat enjoyed an astounding success. Production rose from a negligible amount a century ago to 19 million metric tons today (42 billion pounds). How did this happen?

**Don Tyson expanded chicken marketing to a truly national scope and then diversified into pork and beef to form a protein company.**

*Courtesy of Fred Miller*

**Frank Perdue used product differentiation to market his branded yellow tinged chicken to consumers.**

*Frank Perdue image courtesy of Perdue Farms, background from iStockPhoto.com*





### Museum at the first original Kentucky Fried Chicken Cafe in Corbin Kentucky USA

*Courtesy of Fred Miller*

Although the development of the industry took the combined efforts of thousands of people, this article takes note of just a few years.

### Commercial poultry production by mistake

Cecile Long Steele (1900-1940), also known as Wilma Steele, of Delaware is credited with starting, quite by accident, the broiler industry 93 years ago. Her first broiler flock was a mistaken delivery of 500 chicks for a laying flock instead of the 50 chicks she ordered. She decided to grow them all for meat. When the surviving 387 chickens reached two pounds live weight (many weeks later) she sold them all reportedly for a hefty profit. She knew immediately she was on to something.

### Vertical integration takes hold in 1940s

That first phase of the broiler industry was one of mostly small commercial flocks. After Cecile, the next phase of the industry could be described as the development of vertical integration. Jesse Jewell (1902-1975) of Gainesville, Georgia, is credited with being the first to coordinate the broiler production stages. The independent businesses that once were involved in different stages of production were combined by “integrators.” The inte-

## 12 trailblazers in the US poultry industry

Listed by name, year of birth/death, birth state, position, accomplishment

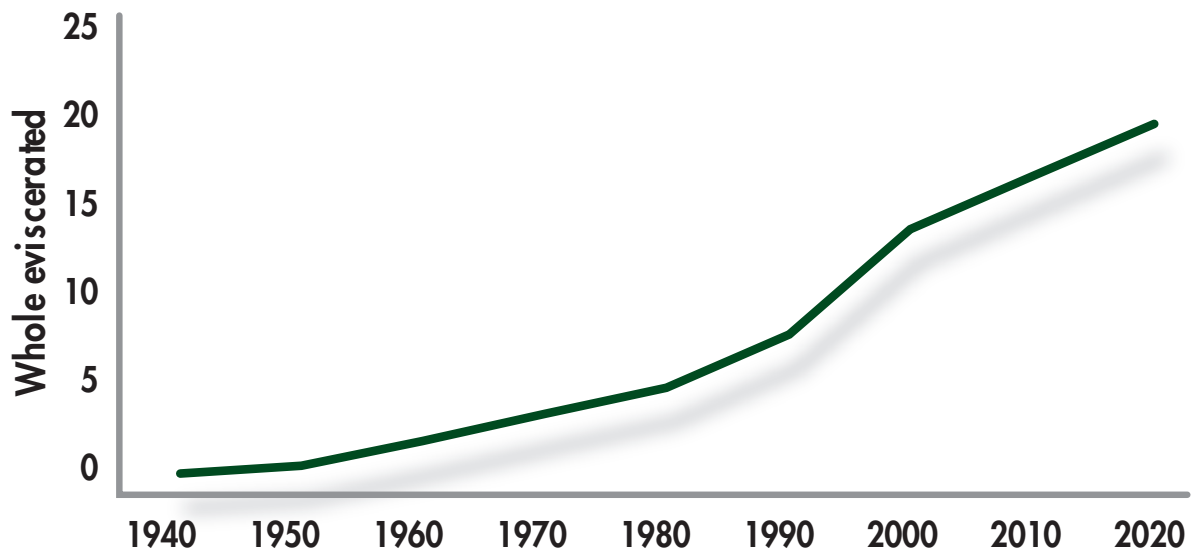
- **Justin Smith Morrill** (1810-1898), Vermont – House of Representatives, Washington D.C.: Wrote the bill that established the U.S. land-grant system of agricultural colleges
- **Colonel Harlan Sanders** (1890-1980), Indiana – Kentucky Fried Chicken, Shelbyville, Kentucky: Invented a global fried chicken franchise
- **Dr. Leo Norris** (1891-1986), New York – Cornell University, Ithaca, New York: Legendary educator and a founder of poultry nutrition as a science
- **Cecile Steele, known as “Wilma Steele”** (1900-1940), Delaware: Credited with starting the broiler industry 93 years ago
- **Jesse Jewel** (1902-1975), Georgia – J.D. Jewel Company, Gainesville, Georgia: Invented vertical integration in the broiler industry
- **Jack DeWitt** (1911-2012), Michigan – Big Dutchman, Holland, Michigan: Marketed the first automated poultry feeder produced on a commercial scale
- **Henry Saglio** (1911- 2003), Connecticut – Arbor Acres Farms, Glastonbury, Connecticut: The father of the modern white feathered broiler
- **Frank Perdue** (1920-2005), Maryland – Perdue Farms, Salisbury, Maryland: Developed and marketed the first real branded product
- **Dr. Bob Baker** (1921-2006), New York – Cornell University, Ithaca, New York: Inventor of the chicken nugget and 40 other chicken products
- **Don Tyson** (1930-2011), Arkansas – Tyson Foods, Springdale, Arkansas: Took the industry to a giant new level
- **Dr. Richard Witter** (1936- ), Maine – Regional Poultry Research Laboratory, East Lansing, Michigan: Used turkey herpes virus as vaccine for Marek’s Disease in chickens; the first cancer vaccine
- **Jim Sumner** (1947- ), Illinois – USA Poultry and Egg Export Council, Stone Mountain, Georgia: The master of global chicken diplomacy

## US POULTRY PRODUCTION

# US broiler production, 1940-2020

x 1 million metric tons

Source: Dr. Paul Aho



**The adoption of vertical integration and the application of scientific production and marketing techniques made chicken a bountiful and low-priced meat protein.**

integrated) production stages under one enterprise.

Jesse Jewell opened his own hatchery in 1940. That was soon followed by a processing plant and feed mill. He left the growing of the chickens to con-

tract growers. For a time, he was the largest vertically integrated producer in the world.

While the structure of the industry was under radical revision, the location was changing as well. The Midwest

and most of New England were abandoned as the industry became vertically integrated. The Southeast rose to broiler production prominence by capitalizing on the novel vertically integrated structure and unmatched

## 100 years of US poultry industry progress, 1917-2017

	Industry form	No. players	Product	Marketing orientation	Economies of scale (head/year)
1917-40	Small, commercial flocks	Thousands	Live chicken	Mostly local	10,000
1940-70	Vertical integration	Hundreds	Processed whole and parts	Regional	50,000,000
1970-2014	Marketing development	Fifty	Whole, parts, further processed chicken	National, international	200,000,000
2014 and forward	Transformation to food companies	Dozens	Proteins of all kinds	International	500,000,000

Source: Dr. Paul Aho

**In their transformation to food companies, poultry businesses will be more global and, to satisfy economies of scale, very large.**



**Read more: Global food companies will control the poultry industry, [www.WATTAgNet.com/articles/30017](http://www.WATTAgNet.com/articles/30017)**

advantages of low-cost land, labor and transportation services.

This phase of industry development was highly innovative on the production side of the business but not so much on the marketing side. Iced, whole broilers were brought out onto the dock of the plant (remember the old Georgia Dock price?) and sold for whatever the market would offer.

While many of the stages of production were swallowed up by the vertically integrating industry, the remaining ancillary industries outside of the poultry firms were growing rapidly. These included primary breeding and pharmaceutical companies as well as host of other companies related to poultry equipment, agricultural lending, specialized vehicles and many others (even economists!).

## Marketing geniuses transformed poultry industry

The next phase of the industry

started when chicken companies turned seriously to the question of marketing. One of the key components of marketing is developing a brand and an early genius at branding poultry was Frank Perdue (1920-2005).

Frank Perdue used a classic tool of marketing, product differentiation, to market his branded yellow tinged chicken to consumers. He was one of the first CEOs to appear on television. He is most famous for saying that it takes a tough man to make a tender chicken. In a memorable segment, he asked the question, "Why would you want to eat an unidentified frying object?"

The marketing phase increased the size of each surviving player (now just in the dozens) and those surviving players no longer sold just whole chicken. They added cut-up chicken, deboned chicken breast meat as well as processed and cooked items. The marketing horizon shifted as well to national and international.

## Expanding marketing

Another iconic marketing genius of the marketing phase of the industry was Don Tyson (1930-2011). Don Tyson was in a hurry to create a company of an unimaginable size. By 2012, Tyson foods pushed beyond 2 billion chickens slaughtered in a single year. Tyson created a new definition of the economies of scale in production and marketing. He was the first to expand chicken marketing to a truly national scope and then the first to diversify into pork and beef

becoming not a chicken company but a protein company.

## Now come the food companies!

The next phase of industry is now taking place. In this stage, chicken companies are likely to transform into food companies leaving behind their strictly chicken roots. In this phase, marketing will be truly global and, to satisfy economies of scale, i.e., most companies, will be very large.

The year 2014 is chosen as the year that the next phase of the broiler industry started. It was in that year that Tyson purchased Hillshire Brands. The purchase of Hillshire for \$8 billion in 2014 moved the company in the direction of branded protein packaged food and away from its origins as a chicken company. In effect, Tyson is becoming a food company.

This article highlights four larger-than-life people who had an outsized impact on the development of the U.S. chicken industry. There are, of course, many others who deserve mention. The accompanying sidebar includes the four and eight more to make a perfect dozen. ■

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*Paul Aho, Ph.D., is owner of Poultry Perspective and economist and consultant. To contact Aho, email [paulaho@paulaho.com](mailto:paulaho@paulaho.com).*



# INFOGRAPHIC:

## A 100-Year History of WATT Publications

Incorporated  
July 6, 1917

1917



Purchased *Poultry Tribune* –  
September 1917  
first WATT issue



Title changed to *Egg Industry* –  
October 1987  
(see also 1977 below)

1927

Established  
*Hatchery Tribune* –  
February 1927



- Title changed to *Hatchery & Feed* – July 1948
- *Feed and Farm Supplier* – February 1961
- *Farm Supplier* – June 1961
- Sold to Miller Publishing Co. – June 1988
- Merged into *Farm Store Merchandising* – August 1988

1934



Purchased *Turkey World* –  
November 1934

- Merged into *Poultry Meat* – September 1964
- Changed back to *Turkey World* – May 1968
- Merged into *WATT PoultryUSA* – January 2000



1950

Established  
*Broiler Growing* –  
September 1950



- Title changed to *Broiler Business* – June 1960
- Merged into *Poultry Meat* – September 1964
- Changed back to *Broiler Business* – November 1975
- Merged into *Broiler Industry* – August 1977

1952

Purchased *U.S. Egg & Poultry* – July 1952



Purchased *Industria Avicola* –  
August 1957

- Title changed to *Poultry Processing & Marketing* – January 1953
- Merged into *Poultry Meat* – September 1964
- Revived as *PPM-Poultry Processing & Marketing* – August 1977
- Discontinued June 1978



1957

1961



Established *Poultry International* –  
January 1962



Purchased *Who's Who in the Egg & Poultry Industries* –  
December 1961  
• Merged into *WATT PoultryUSA* – July 2009

1962

1971

Established *Pig International*



- *Broiler Industry*
- *Egg Industry*
  - Merged into *Poultry Tribune* – August 1977
  - Names reversed – *Egg Industry* (formerly *Poultry Tribune*) – October 1987

1977

Purchased Garden State Publications – June 1977



Established *Feed International* –  
April 1980

- *Poultry Digest* – Discontinued after December 1999 issue
- *Feed Management*
- *Petfood Industry*



1980

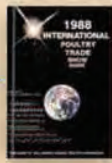
1981

Established *Industria Porcina* – January 1981  
• Discontinued after October 1998 issue



Established *Poultry International China Edition*  
• Discontinued 2001  
• Relaunched 2005 – October issue

1984



Established *International Poultry Trade Show Guide*

- Renamed *International Poultry Exposition Guide* – 1992
- Renamed *WATT Global Media IPPE Directory* – 2015

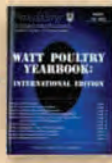
1986

Established  
*Pig International China Edition*



- Discontinued after November 1997 issue
- Relaunched December 2013

1991



Established *WATT Poultry Yearbook: International Edition*  
• Renamed *Executive Guide to World Poultry Trends* – 2000



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