

TASTES LIKE CHICKEN

## How to Satisfy the World's Surging Appetite for Meat

Tastes Like Chicken

By

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The race is on to breed better birds as chicken emerges as the protein of the masses

By Jacob Bunge

**The chickens squawking** in a cinder-block barn near the heart of the Virginia Tech campus in Blacksburg, Va., don't know it, but they play an important part in the plans of the agriculture industry. The challenge: How to feed the 2.4 billion additional people expected to join the global population by 2050.

Unlike the roughly 60 billion chickens world-wide now slaughtered for meat each year, these birds are raised for their DNA. Paul Siegel, professor emeritus of animal and poultry sciences, studies how their genes influence the way they pack on pounds and fight off disease. The research helps companies seeking to breed chickens that will grow faster on less feed and require fewer drugs to stay healthy.

"We're talking about feeding the masses," says Dr. Siegel, 83, who began breeding chickens as a teenager in the late 1940s. His office walls are lined with records charting 50 generations of chicken ancestry. "The question becomes, how do you get there?"

The meat industry has long sought to breed better birds, but the work of geneticists like Dr. Siegel has taken on new urgency as the industry confronts two issues: preparing for a larger, more affluent populace with a growing taste for meat while addressing concerns about how agricultural practices affect the environment, animal welfare and human health.

Food producers face a monumental task. At current consumption rates, the world would need to generate 455 million metric tons of meat annually by 2050, when the global population is expected to reach 9.7 billion, from 7.3 billion today. Given today's agricultural productivity, growing the crops to feed all of that poultry, beef and other livestock would require every acre of the planet's cropland, according to research firm FarmEcon LLC—leaving no room for raising the grains, fruits and vegetables that humans also need.

Producing more meat will be critical because protein is an essential component of the human diet, providing cells with amino acids that the body can't produce itself. Individually, nuts and vegetables can supply some of those amino acids, but animal-based proteins typically deliver all of them—and history shows that people consume more meat as their incomes rise. Chicken is widely expected to be the main choice.

Rising household incomes among rapidly growing populations of developing countries are expected to whet the world's appetite for meat. Global meat production nearly quadrupled over the past 50 years, while the population only slightly more than doubled. Over the next 35 years the world will need to increase meat production by another two-thirds as global GDP roughly doubles, according to United Nations projections.

Agribusiness executives, academics and farmers say they will be able to meet the challenge. The past half-century of agricultural development defied Malthusian doomsday predictions. The "Green Revolution"—emphasizing large-scale crops augmented by fertilizer and pesticides—and other innovations have been so successful at meeting the growing global appetite that there are now more people in the world considered overweight or obese than hungry.

"Does the world have the natural resources to get there? Yes," says Greg Page, executive director of Cargill Inc., the suburban Minneapolis-based agribusiness conglomerate. But feeding a larger population while minimizing the environmental toll will require large-scale food production and technology like genetically modified crops, he says.

Big U.S. agriculture companies have spent decades industrializing the processing of crops and meat. They have bred chickens and livestock to grow bigger more quickly, and they have deployed antibiotics and other drugs and additives to prevent illness and help animals add extra flesh. They have engineered genetically modified strains of corn, soybeans and other components of animal feed to help produce more bushels per acre. And they have mechanized much of the slaughter and processing of animals.

But those approaches increasingly clash with other social priorities, especially in the developed world. Consumers and public health officials in the U.S. and elsewhere are pushing livestock producers to wean animals off antibiotics, arguing that the drugs have hastened the emergence of antibiotic-resistant bacteria. In recent months, meat companies like Brazil's JBS SA and U.S.-based Tyson Foods Inc. have pledged to phase out most or all antibiotics for some of their chickens.

Animal-welfare advocates have also pressed successfully in Western nations for more space and better living conditions for poultry and livestock, arousing consumer anger with video exposés targeting companies including Tyson and Hormel Foods Corp.

Environmentalists and consumers who share their concerns are pressuring companies over water use: Crop and livestock production accounts for nearly 70% of the global total. Some of these groups are also battling the expansion of biotech crops, in part because of fears that they rely on synthetic pesticides and fertilizers blamed for hurting wildlife and water quality. Some groups raise concerns about the crops' impact on human health, though major government agencies and the World Health Organization have deemed them safe to eat.

In the U.S., Vermont passed a law in 2014 requiring food made with such crops to be labeled—a move that food companies fear could prompt shoppers to avoid them—and activists have been pushing similar measures in other states. More than half of European Union member countries have moved to

bar cultivation of genetically engineered crops, and other countries like India heavily limit the use of such seeds.

Critics of the meat giants are working to export their campaigns to developing markets. Humane Society International has opened offices and launched campaigns in countries like India and China. It will soon open an office in South Africa. Farm Animal Rights Movement is developing networks in Central America and elsewhere to steer burgeoning middle classes toward vegetarian diets. Others promote smaller-scale, localized operations that shun widespread pharmaceutical use and provide more spacious pens—or open fields, in the case of free-range chickens.

“If you were scored on how much meat you produced, [the current] system would score very high,” said Ricardo Salvador, director of the food and environment program for the Union of Concerned Scientists. “If you were scored on the environmental and social impact, you would score very low, and you don’t get away with just being scored on one.”

Backyard chicken coops and similar operations can be “a huge resource for rural and small-scale cities,” said Sara Scherr, chief executive of EcoAgriculture Partners, a Washington-based nonprofit that promotes decentralized agricultural production. “Industrial” meat production, she said, carries larger-scale risks, including those associated with animal diseases, which can threaten human health. “It makes a lot of sense to have a more decentralized food system, for a lot of reasons.”

Several startups, including Impossible Foods and Beyond Meat, go further. Backed by funding from investors like Google Ventures and Microsoft Corp. co-founder Bill Gates, they’re betting on burgers and chicken strips made from plant-based substitutes like soybeans and grains.

Big companies say that such approaches aren’t enough. Their focus on scale and efficiency is on display inside a cavernous barn near Phra Puttabat, Thailand, where 20,000 broiler chickens scamper across a bed of discarded rice hulls. These birds are among 240,000 on one of more than 100 farms supplying Cargill’s Thailand poultry plants. Altogether, Cargill slaughters and processes 2.6 million chickens weekly here for shipment to customers including McDonald’s Corp. in Japan and Europe.

Before entering the barn, visitors proceed through four separate showers and two disinfecting sprays before donning baggy blue uniforms and rubber boots—strict biosecurity measures designed to safeguard Cargill’s chickens from avian influenza and other maladies. Inside the barn, chickens perch on low benches and peck at large bottle caps hung from the ceiling as toys, part of “enriched housing” designed to help the chickens stay active—and placate consumers who want better living conditions for animals.

“We want them to feel respected through their entire lives,” Chuck Warta, who heads Cargill’s meat operations in Thailand, says of the birds. “And at the end, one day, they’ll have a bad day.”

Cargill opened its Thailand poultry business in 1990, targeting a region ripe for growth. Within 10 years production capacity had nearly tripled, and by 2006 Cargill was slaughtering 330,000 chickens a day. In 2013 it finished expanding capacity by another third—anticipating even more demand.

Today Cargill exports about 100,000 metric tons of chicken a year from Thailand, and it is discussing hundreds of millions of dollars of investments in new chicken operations in Indonesia and the Philippines over the next few years. Senior Cargill executives say it is likely to start meat-processing operations in the next decade in sub-Saharan Africa, where they expect meat demand will grow as city populations swell. In 2011, rival CP Foods, a Thai conglomerate, built a feed mill and chicken farm in Tanzania that currently supplies other processors.

“We have a high degree of confidence that when people move up into that middle class range...people are going to want to consume more animal-based protein,” said Brian Sikes, a Cargill vice president who oversees meat businesses.

Agribusiness executives say that chicken will be the main meat of the future for several reasons. Its mild flavor and broad cultural and religious acceptance make it more universal than beef and pork. Chicken generally requires less land to produce and is cheaper.

The U.N. Food and Agriculture Organization projects that chicken will overtake pork as the world’s most-consumed meat by 2020, and meat companies are ramping up production. Brazil’s JBS, one of the world’s biggest meat companies, with deep roots in beef, is betting heavily on chicken to become the top global protein, says Wesley Batista, one of two sons of the founder who now run JBS.

Chicken’s rise already is changing time-honored habits. In Argentina, where grass-fed beef has long been central to daily life, per-capita poultry consumption is projected to climb 7.5% this year to a record level, while beef consumption is expected to decline 6.3%. Even in pork-loving China, the government has subsidized large-scale poultry farms and breeding operations over the past decade to increase output.

As this year’s bird flu epidemic in the U.S. shows, chicken also carries risks. Poultry are vulnerable to diseases spread by wild fowl, and the vast numbers and close quarters of domestic flocks mean that contagions can spread rapidly. Fear of disease and contaminated production have slowed anticipated growth in China’s poultry sector, damping business there for Tyson and Cargill.

Breeding experts see solutions to many of the concerns in chickens’ DNA. Because of the birds’ rapid reproduction and quick maturation cycle, geneticists can effect changes in chickens relatively quickly. Already scientists have increased the meat on each bird: Today, a 5.3-pound chicken can be produced in 35 days using about 8 pounds of feed, according to data from Virginia Tech. Thirty years ago, it took a little over 7 pounds of feed to rear a 3-pound bird in the same time. In some cases, breeders have had to solve problems of their own making, like leg problems and heart failure that have arisen as breeding efforts evolved the relatively wiry birds toward broad-breasted specimens.

Scientists completed sequencing of the chicken genome in 2004—before any other major livestock animal. Geneticists are now incorporating gene-scanning technology to better understand how different sequences of poultry DNA interact with one another, and how to emphasize traits that help birds resist disease, which the breeders believe could reduce the poultry industry’s reliance on antibiotics to keep animals healthy.

“We are only at the beginning of understanding everything we can do,” says Olivier Rochard, the global head of the poultry genetics business at Groupe Grimaud, one of the world’s largest suppliers of breeding chickens. Some of the company’s prized purebred birds can now add a pound of weight for every 1.2 pounds of feed consumed, making them among the most efficient weight-gainers in the world.

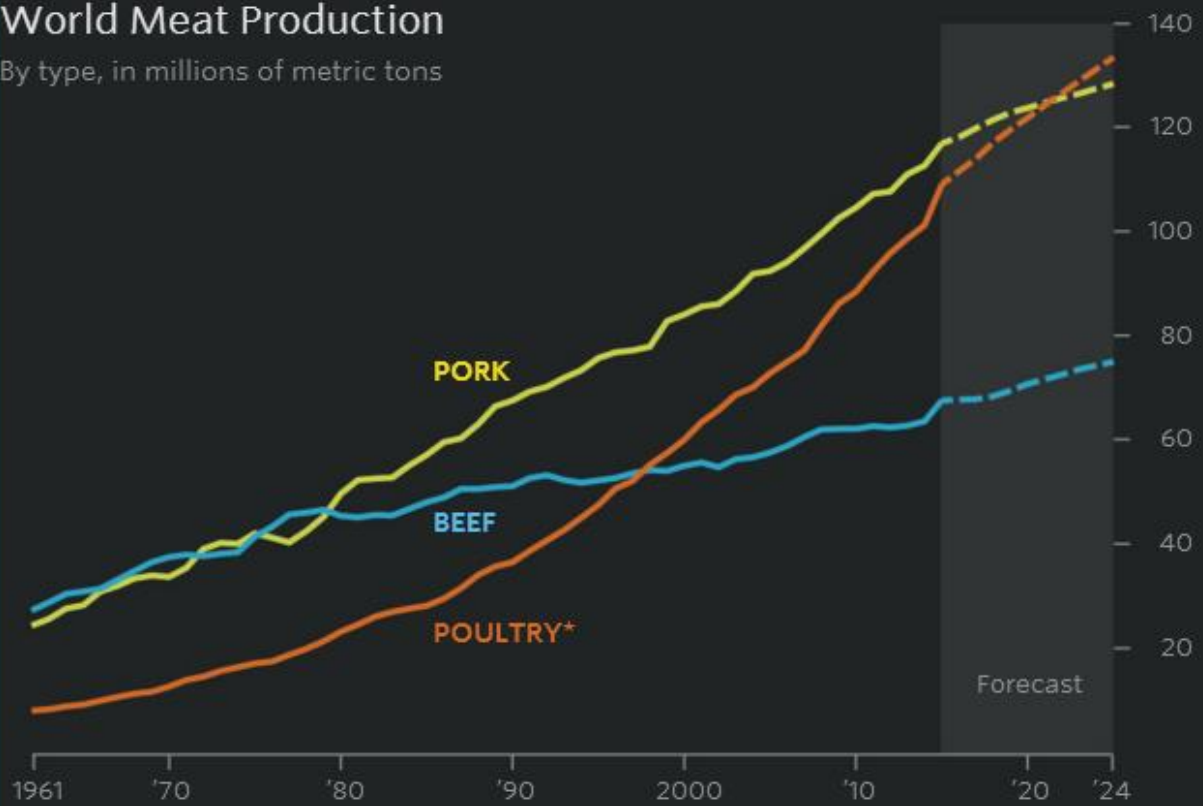
Breeders are deploying the new genomic tools to help pick hens and roosters that can pass along strong immune systems and that respond to probiotics—beneficial living bacteria incorporated into diets, which can help battle germs and prevent illnesses. Through the use of probiotics and stricter biosecurity measures on its chicken farms, Cargill expects, eventually, to be able to eliminate all antibiotics needed to treat human illnesses from its Thailand poultry operations, says Mr. Warta.

Other scientists are looking for traits that will help to reduce the amount of manure the birds produce, while Virginia Tech’s Dr. Siegel is researching how eggs respond to temperature shifts, which could help companies raise chickens that can thrive in hotter temperatures. He says that chicken represents the best bet among the major animal protein groups to help feed the 9.7 billion people expected in 2050, but that people may have to accept some trade-offs in the way it is produced.

“Free range is very nice,” he says, “but how many people are you going to be able to feed with free range?”

# World Meat Production

By type, in millions of metric tons

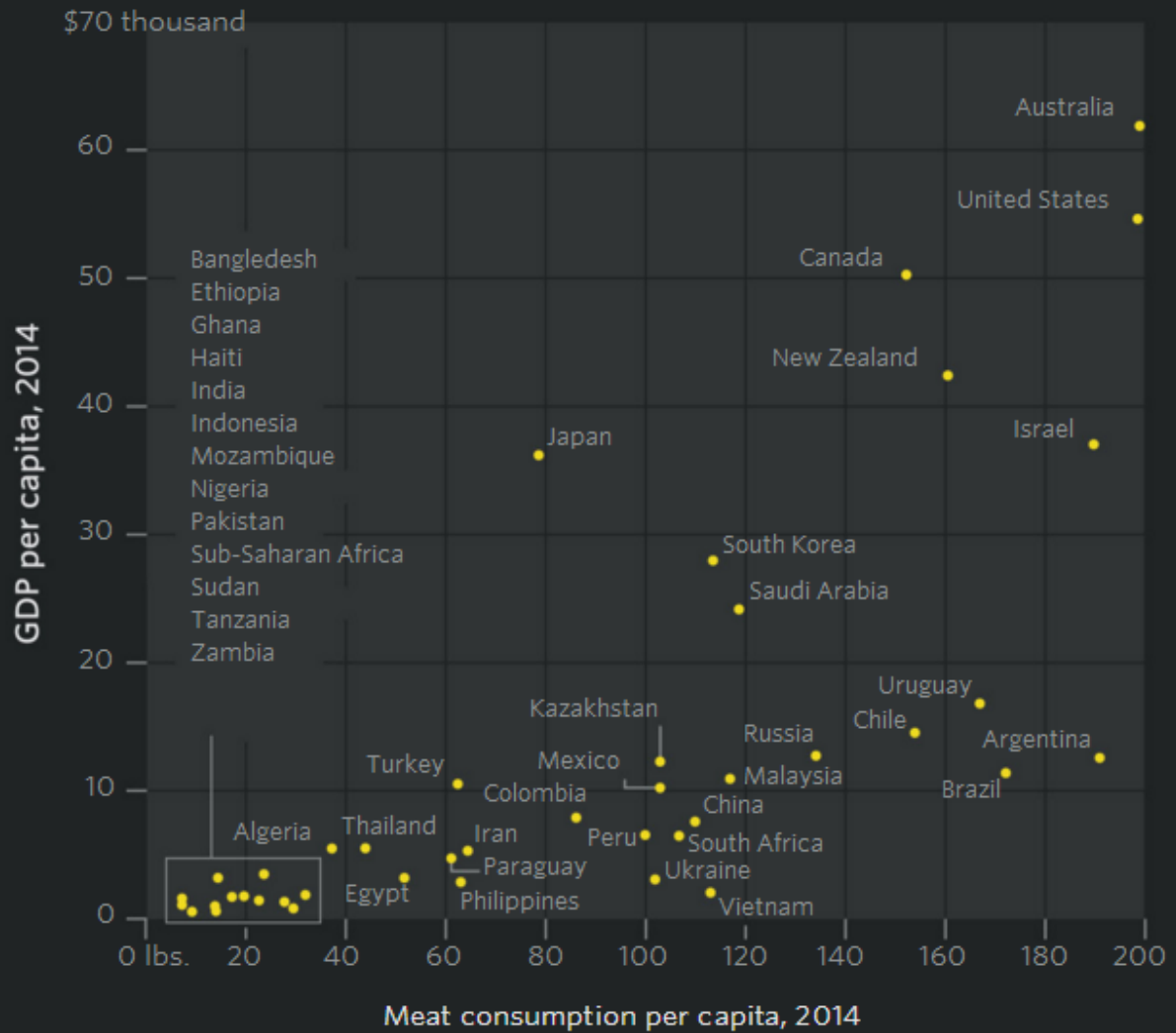


\*includes chicken and turkey

Sources: Food and Agriculture Organization of the United Nations; Organization for Economic Cooperation and Development (forecast)

## Carnivorous Countries

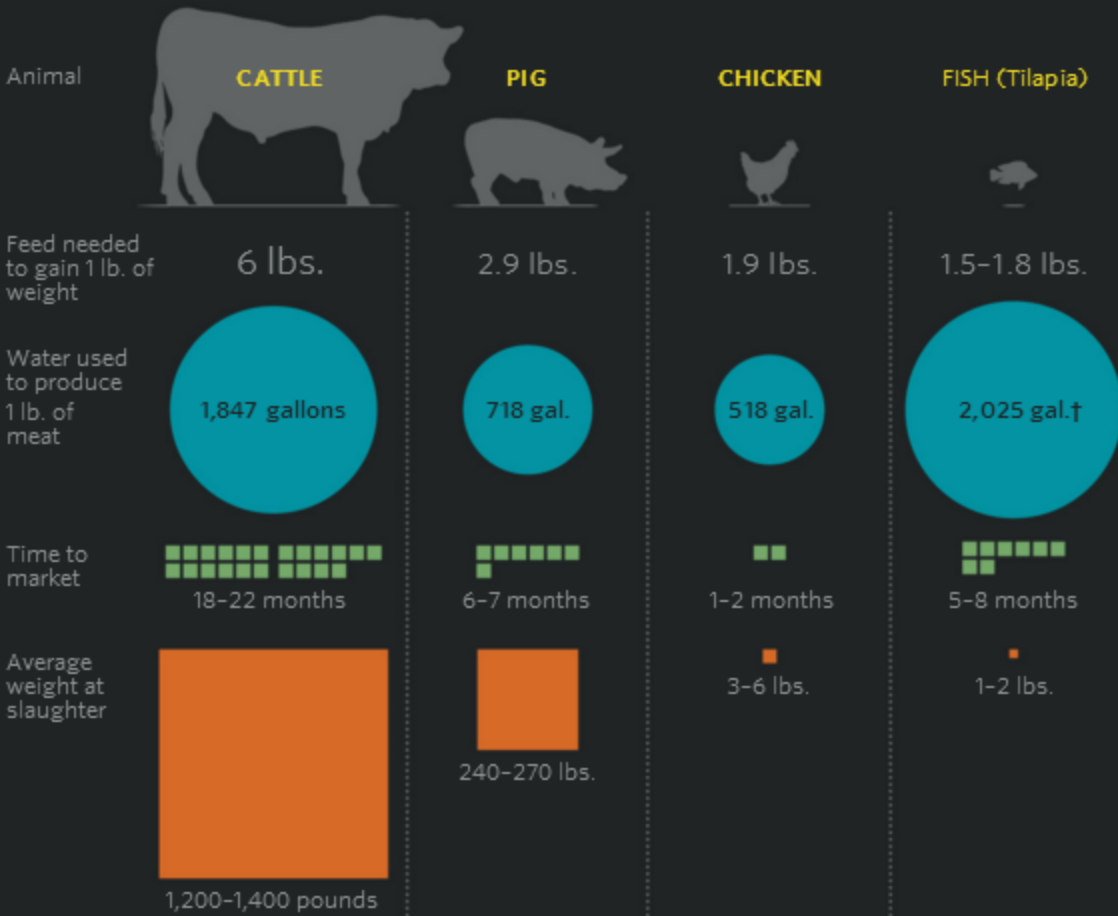
Meat consumption and income are closely correlated, with people—and countries—tending to eat more meat as they become wealthier.



Sources: World Bank (GDP); Organization for Economic Cooperation and Development (meat consumption);

## On Their Way to Market

What it takes to bring four typical industrial-raised animals to market



\*For feedlot-fed cattle †Average for freshwater aquaculture production

Note: Water data includes weighted global average amounts used to produce feed, for drinking water, for services used to maintain the animal's environment, and amounts lost to evaporation, seepage and runoff.

Sources: University of Illinois (cattle ratio); Cattlemen's Beef Board and National Cattlemen's Beef Association (weight, time); Iowa State University (pig ratio); USDA (pig weight, time); National Chicken Council (ratio, weight); Louisiana State University Agricultural Center (chicken time); Food and Agriculture Organization of the United Nations (fish ratio, weight, time); Ecosystems, Mekonnen and Hoekstra, 2012 (water); Water Policy, Verdegem and Bosma, 2009 (fish water)