SWINE OF THE TIMES

The making of the modern pig

By
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My interest in pig sex began over drinks at a bar in Burley, Idaho. My friend Becky was telling me that she couldn't stand her job at a big hog farm outside of town. Each day she faced an unending line of sows, filing into the room where she worked. Occasionally one of the over 200-pound pigs broke ranks, knocking Becky down.

"Sometimes they get nervous when you stimulate them," she said.

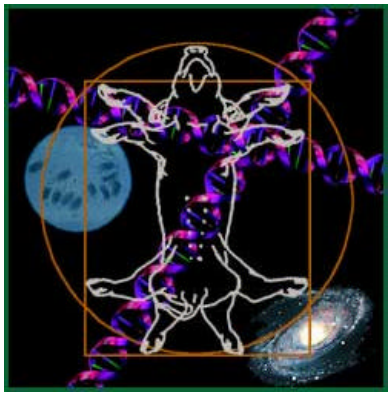
I set down my beer.

"Stimulate?"

"Yeah, for artificial insemination. Usually if you bring a boar around they'll get in the mood. But if not you just have to get in there and start rubbing away."

At my urging, my friend obligingly laid out the intricacies of coaxing sows to conceive, along with equally piquant methods of harvesting boar semen. It all seemed like an awful lot of trouble for something creatures normally do without encouragement.

I love my prosciutto, my bacon in the morning, and although I'm not usually squeamish about the realities of agriculture, I'm not sure I had ever thought of my food as something that depended upon artificial insemination. It began to make perfect sense, of course, when I started to gather the facts. The science of pork production has made major strides in the last twenty years, and one wouldn't expect to find pigs mating the old-fashioned way at state-of-the-art hog facilities. But, as I was to find, artificial insemination ("AI," in the industry) is more than a sign of modernization. It has served as the enabling technology for a process that has transformed pigs from affable, potbellied forest dwellers to panicky, torpedo-shaped clones that cannot survive outdoors but



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nonetheless produce monstrous, lean hams.

Previously, any concerns I might have had about hog farming always vanished right about lunchtime. But when I discovered the ubiquity of this breeding technique I became curious: If it takes human-aided swine masturbation to bring the Christmas ham to the family feast, what else is involved in producing America's pork? Although artificial insemination is by no means the worst indignity inflicted on the modern pig in the course of this transformation, it is a fair symbol for all the other indignities we have visited on it.

THE MODERN FAMILY HOG FARM

To witness the modern fertility ritual Becky had described, and to better understand the industry that has come to depend on it, I visited the Sleezer Fertility Clinic in Aurelia, Iowa.

The Sleezer family keeps two red metal barns full of pigs, spaced a mile apart, off a county road. I passed the first barn and, following Derrick Sleezer's instructions, drove on between barren winter fields of plowed earth. Then I turned down a dirt road and drove toward the second barn and the little cluster of buildings behind it. These hog houses are long, low affairs, built in a simple barracks style, designed to house as many porcine bodies as possible while conserving materials. But as I drove closer I could see the barn design had evolved beyond a devotion to simplicity. White fans dotted one wall like jet engines, making the barns look like a cross between a barracks and a power plant. I parked under a copse of trees between a little prefab office and the farmhouse where Derrick's parents still live.

Derrick Sleezer welcomed me with an earnest handshake. He showed me into the office's brand-new conference room and offered me a soda. He sat down and, looking at me through wire-rimmed glasses, told me his primary goal was to maintain the family's reputation for integrity. He spoke with such sincerity that I believed him without question. Then Sleezer sat back and asked how he could help me. He'd be happy to tell me anything I wanted to know about the farm.

"So, the Sleezer Fertility Center," I asked, "what is it?"

"We're a boar stud," Sleezer said matter-of-factly.

"Oh, right." I scribbled "boar stud" in my notebook, then paused a beat as I reread the words.

"Um, what exactly do you do?"

"We keep the boars here and make fresh semen deliveries."

In the early 1990s, Derrick said, farmers started asking his father, Butch Sleezer, to artificially inseminate their young sows. Then they asked him to hold on to their boars. At that time, big streamlined hog farms were moving into the Midwest and pork producers were shifting from being generalists, crop farmers who kept a few pigs on the side, to being specialists. Tending to the boars, which had once been a single task in a busy day, became a business of its own.

In 1990 artificial insemination accounted for only 7 percent of

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America's swine breeding. At that time large confinement operations were just emerging as industry leaders. These big operations aimed to maximize their efficiency by producing standardized pigs, which grew at predictable rates and produced predictably uniform meat. To make a standardized pig, these companies needed standardized genetics, which they could most easily distribute in the form of semen. According to the most recent count, more than 90 percent of large hog farms used artificial insemination. And with the rise of AI, boar-stud operations, the Sleezers' among them, began to sprout up across the country.

The Sleezers' boars live in the first barn I had passed on the way in. It's located a mile from the other barn in order to reduce the risk of the wind blowing pathogens between the two herds. A chain-link fence, topped with razor wire, keeps away people and animals, which are also potential disease vectors. Nothing meant for human consumption comes out of the building; it produces only semen, delivered to a nearby lab via an underground pneumatic tube. The tube carries the fluid in containers that look very much like those at drive through bank-teller windows.

In the old days, a prize boar might provide natural service to sows on all the local farms. Today, this would be economic suicide for large producers and a literal death sentence for the pigs. The modern pig is so susceptible to disease that producers must take extreme measures to transform their barns into pathogen-free bubbles. The pigs are vulnerable because they live in close quarters; and because they are genetically uniform, a bug that breaches the defenses of one pig's immune system can hop to the next. A bacterium stowing away between a traveling boar's toes could wipe out half a herd. Producers expose their hogs to fewer germs when they bring only the semen from outside rather than the whole boar.

In addition to the chain-link fence and pneumatic tube, Sleezer keeps new boars in quarantine for sixty days and tests their blood three times before moving them in with the rest of the herd. The Sleezers run the farm as a family, but to avoid transporting germs, only Derrick ever enters the boar barn. The swine also receive a small amount of antibiotics in their feed, which helps them fend off sickness. It's a controversial practice because pathogens will eventually evolve resistance to the drugs. But almost all modern farms use low-level antibiotics in feed: besides blocking diseases, antibiotics boost animal growth rates.

Other operations often maintain even more stringent measures than the Sleezers do. One company required a father and son, who worked in different barns, to avoid exchanging germs by eating their dinners apart. The most high-tech facilities start their herds with piglets fresh from the womb, delivered by Caesarian section, scrubbed clean and nursed by a mechanical sow.

Before I even had a chance to ask, Sleezer told me there was no way I was getting in the boar barn. I was a little relieved by the temporary reprieve from my rendezvous with the boars but also disappointed, because I had hoped to witness in full the process my friend Becky had described. I could see I wasn't going to change Derrick's mind, so I asked if I could look inside the other barn, where they keep some 800 sows. That would be up to his father, Derrick said. Butch Sleezer, a tall square-jawed man, agreed, on one condition:

He looked me in the eyes and asked, "Now, you've got to be honest with me here. You haven't been around any other pigs recently have you?"

Since I had not, Butch took me to the house to dress. He gave me a blue jumpsuit, an orange hooded sweatshirt, and a pair of plastic booties. We paused just outside the barn while I, feeling a bit awkward in my makeshift biohazard suit, pulled the thick plastic slippers over my shoes. This, I thought, is what it must have been like to call on the aging Howard Hughes. As Butch explained, the coverings would protect both the pigs from germs on my clothes and my clothes from the ammonia fumes in the barn.

"I'd pull that hood up if you don't want it to get in your hair," he said, before we entered the barn. We stepped into a narrow hallway, well lit, with white plastic walls. Machinery hummed softly. The concrete floor was spotless. It might have been a hospital. Around a corner stood a row of doors, each with a control panel. Butch opened one and I put my head inside. The atmosphere was as I'd imagined it would be on Venus: thick, warm, and caustic. But Butch was pleased.

"We spend more money on propane for heating so we can keep the ventilation going," he said. "You go into some of these places, you can't hardly breathe."

There were about twenty-five sows inside, each confined by a metal crate to an area about two and a half by seven feet. The sows filled their cages. They had a foot or two in which to move forward or back, and enough room to lie down but not enough to turn around. Each had a litter of suckling pigs. The Sleezers sell the piglets to other farmers, who raise them for meat.

Butch swung the door closed and pointed to a panel on the hallway wall.

"Everything is controlled right here," he said.

The machinery sets the angle of the louvers that draw fresh air from outside; it monitors the ventilation fans, adjusts the heat, and turns on the lights. Should the room fall six degrees below the optimum temperature, the control panel calls all the Sleezers' telephones. I grinned at Butch. There was something appealing in the thought of this ever-vigilant mechanical farmer making minute adjustments in the atmospheric composition and heat.

Keeping pigs at just the right temperature allows them to devote every ounce of energy to one purpose: growth. Well, growth and survival. The modern pig is bred too lean to survive Iowa's winters. The blanket of fat that insulates pigs against the cold does not fetch the

price of muscle—that is to say, meat. But producing a layer of back fat takes energy, and energy means feed, which in turn means money. So geneticists have bred most of the lard out of the hog in the last fifty years. Now many of these pigs cannot survive outside the womb of the humming, computerized barn.

Butch led me down the hall, and we peered into two other rooms.

"Look at the uniformity of these litters," he said with pride, counting. "Two, four, six—ten in that one."

The piglets looked like they had all been cast in the same mold; they most probably did have the same father. Meatpackers want identical pigs, the better to give customers identical hams. Artificial insemination makes this possible, because breeders can distribute semen from a single exemplary boar all across the country.

This cookie-cutter perfection, however, becomes a liability when a pig gets sick. (If one hog lacks immunity to a disease, it's likely the others with the same AI father will as well.) But the demand for uniformity outweighs this risk. The more similar the swines, the more easily they fit into the mechanized system, increasing efficiency. For instance, as swine carcasses move down the conveyor belt, at Hormel's Austin, Minnesota, packing plant, they hit a curved knife, which slices the cylindrical loin from the inside of the body cavity. If the animals aren't just the right proportions, the knife will hit the wrong spot, wasting meat or cutting into bone.

The meatpacking plant is the model for the efficiencies we associate with factories. After paying a visit to a disassembly line at a slaughterhouse, Henry Ford went back to his Highland Park auto plant and designed something he called an "assembly line."

Before leaving the barn, Butch Sleezer showed me the gestation room, a much larger space, which houses about 700 clean, white sows. The hogs stood in tight formation, row upon row stretching off to the end of the building under dusty, yellowish lights. Crates held the pigs in line with their noses next to a water trough and their tails over a slatted floor. The pigs had scattered the remains of their seed meal breakfast across the floor. The animals eat where they stand and deposit their dung at the other end of the crate. The pig's own feet, or a shot with a hose, sends the waste through the cracks in the floor.

The Sleezers' facility is typical of a clean, well-functioning hog operation. The Iowa Pork Board had guided me to the Sleezer Fertility Center as an example of a good, up-to-date facility. It was as close as I would come to one of the megafarms. But as far as I could tell from videos and reports about the larger facilities, the conditions in a swine-confinement operation depend less on its size than on the predilections of the producers who run it, on their sense of personal investment, pride, and responsibility.

Producers sometimes keep sows in group pens, which allow them to walk around and socialize. But in confinement, pigs sometimes go a little crazy. They often attack one another, sometimes killing and eating their pen mates. Group pens do not provide enough room for a bullied sow to escape her tormentors.

As we walked down the narrow path between two rows of pigs, the barn filled with the crash of metal and unholy screaming. The sows bellowed, squealed, and recoiled. Others lunged against the bars as we passed.

"They can tell when a stranger comes in," Butch said.

I could see how such cramped quarters might facilitate the spread of disease. In 2000 the U.S. Department of Agriculture tracked the number of times diseases flared up on 895 hog farms, comparing operations of less than 2,000 animals with those of more than 10,000. Pigs housed in large barns are more likely to catch respiratory diseases from their neighbors. The giant producers reported three times the number of mycoplasma pneumonia cases, more than six times the cases of swine influenza, and twenty-nine times the cases of a new flu strain than the smaller farms.

Yet I couldn't argue with the logic of the system. The Sleezers had taken on the cost of this barn with the hope that they could use it to make a little more money. Every square foot of barn space added to the debt. Every square foot not occupied by a pig decreased their ability to pay it off. And if the competition uses such methods to produce more pigs for less money, how can you not?

The Sleezers have dealt with disease in the past, Derrick had told me, but when I saw them, the animals looked healthy. Partway down the aisle, Butch stopped and pointed to the ceiling.

"Feel the air? It comes down from there and hits there—right across the shoulders." He made a slicing motion down the line of pigs. "That way every one of them has fresh air."

Fresh air is especially important in a room suspended above an open septic system. The feces fall through the slatted floors into a cellar. Water periodically flushes it out of this basement into an open reservoir behind the barn.

When we stepped outside, we came into view of this lagoon, a bowl-shaped depression. But beyond this pond the Sleezers have a more modern sewage unit under construction: a concrete swimming pool, bristling with rebar. At the far end, a backhoe muscled loads of mud out of a drainage trench.

The government had given them a choice, Sleezer said. Either do a soils study to determine if the earthen lagoon could leak, or put in a concrete tank. The Department of Agriculture's Environmental Quality Incentives Program had paid for half of the $150,000 tank, but not for the unforeseen cost of the backhoe after a rainstorm clogged the drainage pipes with mud.

The Sleezers also grow crops, so they can apply manure to the fields as a fertilizer before planting. But when pork producers reach a certain size, this tidy cycle—manure to corn to pig to manure—breaks down. Bigger producers must use other methods to dispose of waste, because there is simply not enough

nearby land to absorb it. One of the biggest producers, Circle Four Farms in Utah (owned by a Smithfield subsidiary), uses the simple miracle of evaporation to spirit away the equivalent of 194 Olympic-size swimming pools full of liquefied manure annually. The wind carries the fecal matter away in the form of ammonia, particulates, and gases.

By combining crops, sows, and semen, the Sleezers have retooled the family farm to survive in this era of giant pork producers. But the future of even such modern operations is in doubt. A 1997 paper published by the Federal Reserve Bank of Chicago coolly observed, "The standards set by the largest hog producers now suggest that some 50 producers could account for all the hogs needed in the U.S." The standards of efficiency set by industrial agriculture have decimated Midwestern farms. As I drove away from the Sleezers', along back roads, I passed one empty house after another—relics of the old rural economy. Outside of the town of Manson I saw a small, hand-painted sign. "We appreciate your business," it read, in faded script. It was such a pathetic and ineffectual plea for salvation, probably the work of some local economic-development committee. This is what the small farming towns of the Midwest have come to.

Before I left the Sleezer farm, I'd asked Butch if taking on the debt to build his high-tech barns made him nervous.

He nodded grimly. The industry technology evolves so quickly it's impossible to keep up, he said. Yet it's also impossible not to try. "That's the thing about being in the hog business and building these buildings," he said. "They're tombstones."

A DATE WITH THE INSEMINATOR

Rain was falling hard on the walnut groves that surround WD Swine Farm in Modesto, California, when I arrived to meet the inseminator. I had come because Ryan Watje had agreed to let me observe the way the modern pork chop begins. I knew I was in the right place when I saw the Ford F250 with a vanity plate reading WDSF and a license-plate frame proclaiming, "I smell $ Money $."

Money, on a hog farm at least, has a sharp fecal odor, which burns a bit as it slides past the palate. But the scent was not overpowering, and after a few minutes it faded into the background. The fact that the stench intrudes on consciousness only for a brief period of familiarization is testament to the size of Ryan Watje's farm; with just 200 hogs, it's tiny by modern standards.

I found Watje behind his barn; his curly brown hair was wet and his jeans were spattered with mud. For the last few years Watje, who is thirty-five but seems younger, has been breeding pigs that routinely win top honors in his state, and recently his pigs placed as grand champion and reserve champion at the National Barrow Show.

"I'm the guy everybody's after," Watje said, ending the sentence with a short, sardonic laugh, embarrassed to have said something so prideful.

Watje manages to make a living selling his prize pigs and semen from the boars that sired them. Although he is good at what he does, Watje is a small-timer. He sends most of his semen to people raising show pigs for 4-H or county fairs. He gets his business by word of mouth, whereas big genetics companies, like Lean Value Sires, issue catalogues full of boars. These catalogues display the top studs—each shaved, oiled, and photographed to display bulging muscles and massive scrotums. The captions beside the pictures are filled with warlike language: "With a head and neck made to cause panic and a butt that exceeds all the limits of man and nature," reads the blurb next to a pig named Hung Jury, "he's a cold blooded killer out to eliminate the competition."

Sometimes Watje will buy semen from these boars to bring in "extreme traits." But mostly he uses semen from his own boars to breed "a good functional, all-around pig." His hogs live in open-air, steel-barred pens with an awning to keep the rain off. Because the pigs live outside, they need immune systems strong enough to block the occasional disease. For this reason, Watje uses vaccines and antibiotics only in emergencies. He prefers to let diseases pass through the herd, allowing the animals to develop immunities and weeding out the weakest pigs.

Show-pig breeders, who select for attributes like disease resistance and aesthetic appeal, maintain a small but crucial well of genetic diversity. John Mabry, director of the Iowa Pork Industry Center, says that since big farms started taking over, the number of independent breeders has plummeted and people like Watje now play an important role as stewards of rare genes. Whereas industry geneticists strive for uniformity and move in roughly the same direction, chasing the market, show-pig breeders make decisions based on their personal judgment, intuition, and, sometimes, whimsy. In the past, when large companies found they had over-bred their swine, they have dipped into this well of genetic diversity to revitalize their herds.

"The impact of the independents has been invaluable," Mabry said. "We would never have gotten to where we are without them."

Without genetics from these independents, the industry could not have developed such highly efficient, lean pigs. Unlike plant seeds, scientists cannot simply put animal genetics in the freezer—it's too iffy to freeze and revive eggs and embryos. The only sure way to maintain diversity in pigs is to maintain diversity in farmers.

On the day I visited WD Swine Farm, Watje had decided to mate a Yorkshire sow with one of his newest boars—an experimental and somewhat random pairing, he said.

The boars were as big and as furry as bears. Each had its own pen—but in the last stall, in place of a pig, was what looked like a blue plastic saddle standing a few feet off the ground. Watje opened

this gate and led a white boar into the corral.

"I've been training this one." Watje said. "We'll see how he does."

The boar walked straight to the dummy and mounted without hesitation. Now, to be fair, this is a position few mammals are able to maintain with grace. But this boar, no doubt due to his lack of experience, made the pose look particularly awkward. One foreleg bent under his body. His back arched and his head lolled on the saddle.

Watje reached under the pig's belly with one latex-gloved hand and squeezed a stream of clear liquid onto the ground.

"You want to get all the urine out of there," he said. "Then you just hold on to the penis, which can be difficult because it's slimy."

He saw the look on my face and laughed. "Sometimes it's so slippery I have to take the glove off to hold on."

The tip of a boar's penis is shaped like a corkscrew, which gives the semen harvester something to grip. The hog doesn't need friction, just pressure.

The boar, meanwhile, was shifting, working his way around the dummy. Perhaps he had realized that things were not quite going according to plan and had hit on the idea that he had picked the wrong side. Watje rolled his eyes and hung on. When the moment came, he signaled me and I handed him the cup—an insulated coffee mug lined with a plastic bag and covered in cheesecloth. Watje pulled the penis—two feet long and pencil-thin—to the cup's mouth and held it for three long minutes as the boar ejaculated. Then Watje took the cup inside. It held about half a pint.

"Usually I'd dilute it, but I'm out of distilled water," he said, breaking what had become an uncomfortable silence.

"Do you ever stop in the middle of that and think, 'I'm holding a boar's penis'?" I blurted.

Watje laughed. "Sometimes my friends give me a hard time about it. But no, I've been doing this since I was a kid."

He poured some of the liquid into a squeeze bottle and affixed it to a long straw with a sponge on the end. The remaining semen went in a refrigerator—he sends it overnight to buyers at fifty dollars a dose. Depending on the boar, each ejaculate contains enough sperm to fertilize between ten and forty sows.

The sow was easy. Housed close to the boars, she needed no foreplay, none of the haunch and belly rubbing that Becky had described. Watje just sat on her back, facing her tail, and slid the semen straw inside. The sow leaned her heavy head against my shin while he slowly squeezed the bottle empty. Then it was over.

THE CHICKENIFICATION OF THE AMERICAN PIG

American hog farmers have experimented with artificial insemination since the 1930s, but it became standard practice only after vertically integrated megafarms began to dominate the business. Although the pork-packing industry can claim the honor of showing Henry Ford the way to mechanization, it has only recently embraced the principle of vertical integration, which when combined with the assembly line brought Ford and automobile manufacturers such splendid success. It wasn't until 1991 that anyone in the pig world succeeded in expanding Ford's principles beyond the slaughterhouse, back down the food chain, to hog farms. The innovator was Joseph Luter III, who took over Smithfield Foods in 1975. He saw that poultry companies were already turning big profits by building massive chicken farms and controlling every stage of production. If vertical integration could work for chickens, Luter reasoned, it could work for pigs.

Luter wanted to give customers something not often found in nature: uniformity. He wanted shoppers to know exactly what a ham with the Smithfield label would taste like before they bought it.

"And the only way to do that," Luter told a newspaper reporter in 2000, "is to control the process from the farm to the packing plant."

With AI, Luter could distribute a single line of genetics across a thousand farms. Smithfield provided every farmer with the same pigs, the same feed, and the same detailed instructions. Producers only had to build up-to-spec barns and follow orders. This system lifted the burden, and the benefits, of innovation from the producer's shoulders. Some farmers resented being forced into the role of de facto assembly-line workers, but they did not have much choice. They could not compete with the efficiencies of vertical integration. Megafarms sprouted up around Smithfield's packing plant in North Carolina, and in the mid-Nineties other vertical integrators, such as Premium Standard Farms and Seaboard, began moving into the Midwest, the traditional American hog belt. Now Smithfield turns about 20 million hogs into pork every year, making it the world's largest pork producer.

Farmers who wanted to stay in business converted. Many quit. The most stubborn went bankrupt. Between 1979 and 2004, as pork production increased by 6 billion pounds, the number of hog farms in America decreased from more than 650,000 to less than 70,000.

"Farmers with know-how and pride got eliminated," one pork producer who had chosen conversion told me. "This kind of farming doesn't take any talent. The company gives you a plan, a consultant, the feed, and the pigs. All you have to do is follow the plan. People who had no talent thought it was great."

Luter's system demanded that farmers subtly shift the way they looked at their animals. The good farmer had to know his animals. The successful Smithfield producer has to watch his inputs, death rates, and pounds gained per pound of feed to maximize protein production. Instead of paying attention to individual pigs, producers focused on the efficiency of the herd as a whole.

Antibiotic growth promoters like

Tylan are advertised in trade magazines as tools to help producers deal with such abstractions:

"Tylan helps minimize attrition losses and maximize economic returns," one reads. "On average, 30–35% of pigs born never reach full-value market weight because they die, are culled or are lightweights at marketing."

As one Midwestern veterinarian put it, his role has changed from something akin to a family doctor to a public health planner. "The days when I would get called in to see one sick pig are long gone," he said.

Instead, workers dispatch hogs with a bolt gun, or simply swing the runts by their hind legs against the concrete floor. Healing is inefficient.

As the way producers looked at pigs changed, so did the animal itself. Luter needed a brave new pig for his new system, and in 1990, Smithfield purchased exclusive U.S. rights to the genetic lines of extraordinarily lean pigs from the National Pig Development Company. These hogs excelled at efficiently converting feed into salable protein, because they wasted little energy on fat production. As an added benefit, the lean meat they produced appealed to lipophobic Americans. At that time, health-conscious Americans shied away from fatty meats but considered chicken lean and virtuous. In 1986 the National Pork Board had begun an advertising campaign that would recast the pig as a second type of chicken. Pork, advertisers asserted, is "the other white meat." Smithfield made this claim a reality.

As other pork corporations turned to the Smithfield model, breeding companies designed pigs to accommodate the desire for leaner, more efficient swine. Today geneticists have developed tools to reshape pigs almost as ably as Ford's engineers reshape radiators.

WE HAVE GONE TOO FAR

I decided to attend the National Swine Improvement Federation Conference in Ames, Iowa, to find out what the leading lights of the hog industry thought of the animal they had created. Surprisingly, meatpackers, academics, and private-sector scientists all gave me the same answer: We have gone too far.

Geneticists have made great strides in the last decade. The portion of the hog that people can actually eat (as opposed to the skin, bones, and fat) has increased by 1.04 percent—the equivalent of an extra pork chop per pig. Scientists have shaved 12.9 days off the time it takes the animal to reach market weight and increased the area of the loin eye (used as an indicator for general muscle size) by 1.9 centimeters. Sows give birth to an average of 1.56 more piglets per litter. Today's pigs are impressively uniform and grow large lean muscles quickly. But the pork has become so lean that packers often have to inject saline marinades directly into the meat—and chefs must drown it in heavy sauces—to make it palatable. What's more, a combination of over-breeding and stressful living conditions makes a percentage of our pork more acidic and less tasty than it used to be.

Standing in an Iowa State University lecture hall, flanked by dual Power Point screens, food scientist Ken Prusa told the swine improvers that the future of the industry lay in providing customers a "positive taste experience." And providing a positive taste experience means providing less acidic pork, Prusa said.

In pork, acids break down muscle tissue, turning it to mush, bleaching it of color and giving it a slightly sour taste. The industry calls this condition "pale soft exudative" or PSE. Prusa held up a plastic-wrapped loin to the audience. The pale meat slumped around his hand.

"What's all this reddish liquid sloshing around?" he asked.

"Exudate," someone called out. "Purge," said another. "Water."

"Right," Prusa said. To be exact, the fluid is mostly water with some iron, proteins, and trace minerals mixed in. He clicked to a slide showing a microscope photograph of healthy muscle, honeycombed with cell walls. Then he clicked to a picture of pale, soft, exudative meat. The slide showed only a mass of gray.

"When the cell structure breaks down like this, the meat loses ability to retain water," Prusa said.

When cooked, this acidic pork (with a pH below about 5) grows rubbery and dry. But as the pH rises—growing less acidic—the pork becomes, "a taste experience we can only imagine," Prusa said.

"At pH 6.2 and above—I don't know if anyone's ever eaten one of those, but you would not forget it," he said.

For years, the Japanese have been buying all the best meat from American slaughterhouses. They need meat that won't melt to mush in shipping, and they are also more willing to pay for quality food. So far, meatpackers have simply picked the best meat off the disassembly line—from one hog here and another there—to satisfy this demand. The Japanese choose the meat by color: darker pork signifies less acid. Americans get the leftovers: the other white meat. But this is changing, Prusa said. If people want more perfect pork, geneticists may have to breed a different animal.

"What's your definition of perfect pork?" asked an audience member.

"An excellent eating experience," Prusa said.

"But commodity consumers aren't interested in that."

Prusa's response pointed toward a transformed marketplace: "I don't think we're going to have commodity pork much longer."

Instead of settling for "commodity pork"—i.e., the cheapest thing on the shelf—American shoppers seem increasingly willing to pay more for a brand they can trust or for some information about their meat's past. And although cheap, unbranded pork may remain on supermarket shelves, in the future it will probably come from countries like Brazil and China—

countries with cheaper labor and fewer laws preventing farmers from dumping their waste.

At the cocktail party after the lecture, I asked Dan Hamilton, a geneticist for the breeding company Génétiporc, if scientists would be able to reengineer the pig to produce less acidic meat. It's a difficult problem, he said, because many factors govern acidity. It depends, for instance, on how quickly packers cool the meat after slaughter and how people treat the animal beforehand. But geneticists can contribute by breeding more docile animals—pigs that can endure trying conditions without becoming stressed.

When pale, soft, exudative meat first emerged as a major problem, scientists linked it definitively to stress. In breeding the Smithfield-type super swine, geneticists had inadvertently selected for a gene that made hogs prone to panic. Pigs exhibiting this trait might tremble all their lives and die of shock when a barn door banged shut too loudly. Hogs under stress (and humans as well) use an energy-production shortcut, rapidly burning glycogen in their muscles and creating lactic acid as a byproduct. Genetically stressed-out pigs live with their muscles immersed in lactic acid and, unless they die in unusual placidity, their meat goes quickly bad.

Iowa State University Professor Lauren Christian is credited with discovering "the stress gene"—shorthand for a segment of DNA that produced heavily muscled, ultra-lean, but also exceptionally high-strung pigs. In 1995 he called on the industry to eliminate the gene, and the breeders responded. Today most genetics corporations have purged it from their breeding pools. All the same, the problems associated with the stress gene still exist. Farmers still complain of pigs that drop dead when they drive their tractors too close to the barn, and the pork industry still loses money on pale, soft, exudative flesh. The American Meat Science Association found that the amount of PSE pork had increased from 10.2 percent in 1992 to 15.5 percent in 2002, when the problem cost the industry $90 million. Either the genetic causes of stress are more complicated than Christian thought or something else is making the pigs crazy.

If genes are no longer responsible for all this watery, floppy meat, animal living conditions may be the culprit. Scientists have found that the modern pig's monotonous life in cramped quarters puts it on edge. Temple Grandin, a professor of animal science at Colorado State University, has shown that when workers petted pigs for five minutes a day, let them out of their crates for a brief walk, or gave them a piece of rubber hose to play with, the animals calmed down. Pigs are, after all, highly intelligent animals—probably more intelligent than dogs—and, like dogs, they grow restless without anything to do. When swine cannot so much as turn around in their crates, they often develop repetitive movements, biting at the air and swinging their heads from side to side—movements that some students of animal behavior say signal frustration or neurosis.

As breeders have pushed for efficiency, they have also relaxed the standards for physical traits that allow pigs to stand on concrete their whole lives without going lame. Hogs can live up to twenty years in the wild, but large pork producers usually cull sows after less than four years. Sows can produce more than ten litters, and older sows birth larger, healthier pigs. In confinement a sow's health won't hold up much past three litters. Swine producers recognize the problem, and a faction at the conference argued that it was time to make a change.

In an effort to help breeders choose pigs that are less likely to go lame, Dale Miller, editor of *National Hog Farmer,* was distributing posters at the National Swine Improvement Federation Conference. The posters illustrated the good, the bad, and the ugly in hog body types. As I studied the pictures of pigeon-toed pigs, Miller chatted with Peggy Hawkins, a scientist from Monsanto, who had just ordered a set of posters. Monsanto, the agricultural biotech firm most famous for making the herbicide Roundup and Roundup-resistant crops, also sells sows under the registered trademark "Genepacker."

"This lack of soundness has become a real problem," said Miller, who looks like a slim Teddy Roosevelt. "I can't believe the producers have stood for it as long as they have."

"Well, if you buy a sow from Monsanto and it dies, we replace it for free," Hawkins said. "So it doesn't affect the producers one way or the other. We figure they're better off having the top genetics."

"It affects them when they have to drag dead sows out of the crates every day," Miller retorted.

It would be unfair to leave this bit of casual conversation out of context, since, to judge from its marketing, Monsanto recognizes that farmers need durable sows to maximize production, and it specifically positions the Genepacker as a pig with the fortitude to withstand the rigors of confinement.

The solution to this problem of soundness, as far as Monsanto or those at the Swine Improvement Conference are concerned, is to breed "better" pigs—pigs that can stand on a 2'x7' rectangle of concrete all their lives without going lame or insane with boredom. And if genetic modification doesn't work, technology often can provide a mechanical solution. Swine Robotics, for instance, has developed a device that removes dead animals from crates—a contraption that looks like a hand truck with a power winch. This "Boar Buzzard" eliminates the problems of poor employee morale and back injuries. On the PSE front, scientists have found they can reduce pale, soft, exudative meat by taking pigs off their feed a few days before slaughter. The hungry pigs burn off their glycogen reserves, and without glycogen they do not produce lactic acid, no matter how stressed they are.

As practical as they may be, there is something troubling about these technical work-arounds. Bit by bit, scientific breakthroughs have emancipated the hog

industry from the demands of nature, but each freedom comes at a price. Each new liberty for pork producers depends on further control, further domination of the pig. No one at the conference suggested what seemed the obvious answer: doing away with the causes of stress and lameness. But then, swine geneticists are innovators, not policymakers.

In just a little more than a decade, the modern hog industry has produced a tower of efficiency-maximizing products, one stacked atop the next, each innovation fixing the problem the last fix created. It is a monumental, if somewhat haphazard structure, composed of slatted floors and aluminum crates, automatic sorting scales and mechanized wet-dry feeders. It is constructed of Genepacker sows, Tylan antibiotic feed, Agro-Clean liquid detergent, Argus salmonella vaccine, GoldenPig foam-tipped disposable AI catheters, CL Sow Re-placer milk substitute, and Matrix estrus synchronizer. The scientists who add their discoveries to this edifice do not see themselves as its architects. As they see it, their job is not to shift the foundations of the hog industry but to build atop its tower a technology, masking what structural flaws they can with new construction, reaching ever upward.

That night, at the National Swine Improvement Federation Conference dinner, I found myself face to face with three slabs of white pork smothered in gravy. One of the conferees held up the meal long enough to give an invocation.

"Dear Lord," he said, "thank you for giving us the gift of technology and showing us how to use that gift to help the industry we serve, the pork industry …"

He went on for several minutes, giving me time to consider my meat, in light of all I had learned in the past month.

"... and serve humanity without someone looking over our shoulder, amen."

The pork was tender and juicy, but I was having a hard time swallowing it. For the first time since I had had my illuminating conversation with Becky in that bar in Idaho, I knew exactly what I was eating.

There are plenty of good reasons stacked in favor of the system that had delivered the pork to my plate. Or if not good reasons, at least powerful ones. There is tremendous pressure to produce cheap food—and, adjusting for inflation, the price of a pork chop has fallen about a dollar a pound in the last ten years. The pressure to sell cheap lean pork leads to the building of uniform pigs and confinement facilities—which leads to the need for biosecurity regulations. These regulations, in turn, make artificial insemination, in all its absurdity, not only reasonable but necessary. And as I chewed my pork loin, I could not avoid the conclusion: All these powerful reasons for the transformation of hogs into predictable production machines imply the existence of an equally predictable consumption machine, someone like me who expected to find identical cuts of inexpensive pork every time he entered the supermarket.

I had gone in search of artificial insemination's original cause and now I had found it. I swallowed and gingerly took another gravy-laden mouthful. I had never thought of my bacon-eating self as part of the pig industrial complex. Corporations like Smithfield and Pig Improvement Company bear the responsibility for engineering the modern pig, but, as they will point out, they made it to the specifications of their master: the vast collective American maw.

Yet the reduction of humanity to blind and ravenous consumer is not a description of people as they really are. Instead, like the simplification of the pig to a meat-making machine, it is a vision that serves the pork industry's purposes. In reality, shoppers can see perfectly well. But by the time pork reaches the supermarket it has shed all markers that might allow consumers to evaluate their purchase save one: its price. It's no wonder that, when given this solitary criterion for judgment, shoppers choose the cheapest possible meat. Anyone who has dared to ask a supermarket butcher about the origins of a pork chop knows it is almost impossible to learn anything significant and that food workers react to the question as if it were frivolous and slightly impolite.

The industry has responded admirably to the demand for consistent, copious, and cheap pork. But in satisfying those desires, it has done away with the other qualities that once distinguished pork, like flavor and variety. The industry may argue that it simply provides what the consumer wants, but it also has reduced pork variety to the extent that shoppers have no other option. They can select only from what the industry chooses to give them. If I wanted to replicate my revelatory meal, I could find identical pork in any American supermarket. In fact, I'd have a hard time finding any other type of pork.

TOWARD A POSTINDUSTRIAL PIG

A few months after the Swine conference, the magazine *Pork* ran an editorial forecasting consumer demands: quality meat, organics, and animal-welfare assurance, the editor predicted, would be trends in coming years. During the 2005 Academy Awards, the National Pork Board launched a new advertising campaign touting pork for its own charms rather than its similarity to chicken, and Smithfield unveiled its line of high-quality "Preferred Stock" pork, saying it was "going back to the basics" (read "fattier"). It's worth noting that Smithfield, which survives by replacing variety with uniformity, had to look to swine from outside its patented line to go back to the basics. After a decade of modern hog farming there were still places to find alternative genetics. If modern trends had continued for much longer, however, going back might not have been an option.

But while the marketing of pork seems to be making a U-turn, not all that

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much is changing down on the industrial farm. Brands like Prairie Grove and Salmon Creek are charging extra for a promise of "swine welfare assurance" but still squeeze the pig into the same mechanized, indoor system.

Much of the change in marketing is coming about because the pork industry has taken note of the success of a few pork producers who treat their pigs as sentient animals rather than protein units. These farms account for less than 1 percent of the pork in the United States, but their growth is sending shockwaves through the industry because it violates a fundamental axiom of efficiency-based agriculture. It proves that consumers don't always reward those who can best increase efficiency and drop prices.

Before leaving Iowa, I visited Paul Willis, who runs the Niman Ranch Pork Company out of the brick house where he was born. When I arrived, early in the morning, it felt the way I once imagined a farm should feel. Pigeons cooed in a cote and somewhere a rooster proclaimed its wakefulness. It smelled earthy, not septic. But although Willis's place looks like an old-fashioned farm it is also a scientifically sophisticated operation based on a revolutionary idea: "We are trying to adapt to who the pig is," Willis said.

Instead of pushing the pig to the limit of what it can stand so that it will better fit into an efficient system, Willis has created a farm that works in cooperation with the animals. Give the pig what it wants, the theory goes, and in return the pig will thrive and someday make a toothsome meal.

Scientists have shown that when pigs have their druthers, they spend time grazing in pasture and rooting in the earth. Willis consulted these studies and then devised a system that would allow hogs to indulge all their grazing, foraging, socializing, and nest-building instincts. This system allows Willis to dispense with the great heap of gadgets and drugs that confined-animal feeding operations must buy, and when pigs have room to spread out their manure enriches rather than pollutes the soil.

But it's the little things that count. For instance, Willis spends enough time with his sows so that they get to know him. They aren't upset when he comes in and didn't protest when I entered the barn. He firmly believes that a pig that lives a life of placid ease is more likely to become the best tasting meat in the world—and it's his mission to create that meat. Willis isn't interested in maintaining strict genetic uniformity, and his hogs can survive the chance encounter with a germ or two, so artificial insemination is not of much use to him. And since his pigs spend most of their time running around outside, catching them for insemination would be a full-time job. When I asked him if it's more efficient to let the boar do the work, he nodded.

"A boar," Willis said, "is a cheap hired man."

There's no arguing with the price tag, however. A Niman Ranch pork chop costs significantly more than one from Smithfield. Nonetheless, the pork has been a hit. In 1997 the company was producing 120 pigs a week. Now, to keep up with demand, it sends more than 3,000 hogs to slaughter each week. Niman Ranch has 450 farmers growing swine according to its protocols, and Willis is recruiting more.

Willis is particularly proud to be giving these small farmers a way to make a decent living, though he knows Niman Ranch alone can't repopulate the dying towns of the Midwest. We drove together through the town of Thornton, Iowa, and Willis pulled up at his old high school. He had been a Thornton Thunderbolt—a dying breed. As large farms replaced small ones, the population of Thornton became too small to warrant its own high school. Now his high school serves as a middle school for both Thornton and three other towns.

Willis pulled away from his alma mater, and we drove in silence. But his mood brightened a moment later. He stopped the truck and pointed out a group of his pigs in a cornfield. The pigs frolicked. Yes, anthropomorphism be damned, they frolicked amid the dried cornstalks. They dashed off in one direction, only to dash back again. They rolled on the ground. They ran in little circles of porcine glee. They drove their noses into the earth, burying themselves up to their ears.

"There it is," Willis said. "Porktopia." ◘

ABOUT THE AUTHOR

Nathanael Johnson is a freelance journalist in San Francisco. He covers a variety of topics, especially the nexus of science, technology, environment, culture and agriculture. With an interest in food and agriculture stemming from his first job at a newspaper in Idaho, he has gone on to write for many publications, including Harper's Magazine, The New York Times Magazine, Frontline.com, Salt Magazine and some alternative weeklies.