The Way We Live Now: Our Decrepit Food Factories By MICHAEL POLLAN

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The word “sustainability” has gotten such a workout lately that the whole concept is in danger of floating away on a sea of inoffensiveness. Everybody, it seems, is for it whatever “it” means. On a recent visit to a land-grant university’s spanking-new sustainability institute, I asked my host how many of the school’s faculty members were involved. She beamed: When letters went out asking who on campus was doing research that might fit under that rubric, virtually everyone replied in the affirmative. What a nice surprise, she suggested. But really, what soul working in agricultural science today (or for that matter in any other field of endeavor) would stand up and be counted as against sustainability? When pesticide makers and genetic engineers cloak themselves in the term, you have to wonder if we haven’t succeeded in defining sustainability down, to paraphrase the late Senator Moynihan, and if it will soon possess all the conceptual force of a word like “natural” or “green” or “nice.”

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Confucius advised that if we hoped to repair what was wrong in the world, we had best start with the “rectification of the names.” The corruption of society begins with the failure to call things by their proper names, he maintained, and its renovation begins with the reattachment of words to real things and precise concepts. So what about this much-abused pair of names, sustainable and unsustainable?

To call a practice or system unsustainable is not just to lodge an objection based on aesthetics, say, or fairness or some ideal of environmental rectitude. What it means is that the practice or process can’t go on indefinitely because it is destroying the very conditions on which it depends. It means that, as the Marxists used to say, there are internal contradictions that sooner or later will lead to a breakdown.

For years now, critics have been speaking of modern industrial agriculture as “unsustainable” in precisely these terms, though what form the “breakdown” might take or when it might happen has never been certain. Would the aquifers run dry? The [pesticides](http://health.nytimes.com/health/guides/nutrition/pesticides/overview.html?inline=nyt-classifier) stop working? The soil lose its fertility? All these breakdowns have been predicted and they may yet come to pass. But if a system is unsustainable — if its workings offend the rules of nature — the cracks and signs of breakdown may show up in the most unexpected times and places. Two stories in the news this year, stories that on their faces would seem to have nothing to do with each other let alone with agriculture, may point to an imminent breakdown in the way we’re growing food today.

The first story is about MRSA, the very scary [antibiotic](http://topics.nytimes.com/top/news/health/diseasesconditionsandhealthtopics/antibiotics/index.html?inline=nyt-classifier)-resistant strain of Staphylococcus bacteria that is now killing more Americans each year than [AIDS](http://health.nytimes.com/health/guides/disease/aids/overview.html?inline=nyt-classifier) — 100,000 infections leading to 19,000 deaths in 2005, according to estimates in The Journal of the [American Medical Association](http://topics.nytimes.com/top/reference/timestopics/organizations/a/american_medical_association/index.html?inline=nyt-org). For years now, drug-resistant staph infections have been a problem in [hospitals](http://topics.nytimes.com/top/news/health/diseasesconditionsandhealthtopics/hospitals/index.html?inline=nyt-classifier), where the heavy use of antibiotics can create resistant [strains](http://health.nytimes.com/health/guides/injury/strains/overview.html?inline=nyt-classifier) of bacteria. It’s Evolution 101: the drugs kill off all but the tiny handful of microbes that, by dint of a chance mutation, possess genes allowing them to withstand the onslaught; these hardy survivors then get to work building a drug-resistant superrace. The methicillin-resistant staph that first emerged in hospitals as early as the 1960s posed a threat mostly to elderly patients. But a new and even more virulent strain — called “community-acquired MRSA” — is now killing young and otherwise healthy people who have not set foot in a hospital. No one is yet sure how or where this strain evolved, but it is sufficiently different from the hospital-bred strains to have some researchers looking elsewhere for its origin, to another environment where the heavy use of antibiotics is selecting for the evolution of a lethal new microbe: the concentrated animal feeding operation, or CAFO.

The [Union of Concerned Scientists](http://topics.nytimes.com/top/reference/timestopics/organizations/u/union_of_concerned_scientists/index.html?inline=nyt-org) estimates that at least 70 percent of the antibiotics used in America are fed to animals living on factory farms. Raising vast numbers of pigs or chickens or cattle in close and filthy confinement simply would not be possible without the routine feeding of antibiotics to keep the animals from dying of [infectious diseases](http://health.nytimes.com/health/guides/specialtopic/travelers-guide-to-avoiding-infectious-diseases/overview.html?inline=nyt-classifier). That the antibiotics speed up the animals’ growth also commends their use to industrial agriculture, but the crucial fact is that without these [pharmaceuticals](http://topics.nytimes.com/top/news/health/diseasesconditionsandhealthtopics/drugspharmaceuticals/index.html?inline=nyt-classifier), meat production practiced on the scale and with the intensity we practice it could not be sustained for months, let alone decades.

Public-health experts have been warning us for years that this situation is a public-health disaster waiting to happen. Sooner or later, the profligate use of these antibiotics — in many cases the very same ones we depend on when we’re sick — would lead to the evolution of bacteria that could shake them off like a spring shower. It appears that “sooner or later” may be now. Recent studies in Europe and Canada found that confinement pig operations have become reservoirs of MRSA. A European study found that 60 percent of pig farms that routinely used antibiotics had MRSA-positive pigs (compared with 5 percent of farms that did not feed pigs antibiotics). This month, the [Centers for Disease Control and Prevention](http://topics.nytimes.com/top/reference/timestopics/organizations/c/centers_for_disease_control_and_prevention/index.html?inline=nyt-org) published a study showing that a strain of “MRSA from an animal reservoir has recently entered the human population and is now responsible for [more than] 20 percent of all MRSA in the Netherlands.” Is this strictly a European problem? Evidently not. According to a study in Veterinary Microbiology, MRSA was found on 45 percent of the 20 pig farms sampled in Ontario, and in 20 percent of the pig farmers. (People can harbor the bacteria without being infected by it.) Thanks to Nafta, pigs move freely between Canada and the United States. So MRSA may be present on American pig farms; we just haven’t looked yet.

Scientists have not established that any of the strains of MRSA presently killing Americans originated on factory farms. But given the rising public alarm about MRSA and the widespread use on these farms of precisely the class of antibiotics to which these microbes have acquired resistance, you would think our public-health authorities would be all over it. Apparently not. When, in August, the Keep Antibiotics Working coalition asked the [Food and Drug Administration](http://topics.nytimes.com/top/reference/timestopics/organizations/f/food_and_drug_administration/index.html?inline=nyt-org) what the agency was doing about the problem of MRSA in livestock, the agency had little to say. Earlier this month, though, the F.D.A. indicated that it may begin a pilot screening program with the C.D.C.

As for independent public-health researchers, they say they can’t study the problem without the cooperation of the livestock industry, which, not surprisingly, has not been forthcoming. For what if these researchers should find proof that one of the hidden costs of cheap meat is an epidemic of drug-resistant infection among young people? There would be calls to revolutionize the way we produce meat in this country. This is not something that the meat and the pharmaceutical industries or their respective regulatory “watchdogs” — the Department of Agriculture and F.D.A. — are in any rush to see happen.

he second story is about honeybees, which have endured their own mysterious epidemic this past year. Colony Collapse Disorder was first identified in 2006, when a Pennsylvanian beekeeper noticed that his bees were disappearing — going out on foraging expeditions in the morning never to return. Within months, beekeepers in 24 states were reporting losses of between 20 percent and 80 percent of their bees, in some cases virtually overnight. Entomologists have yet to identify the culprit, but suspects include a virus, agricultural pesticides and a parasitic mite. (Media reports that genetically modified crops or cellphone towers might be responsible have been discounted.) But whatever turns out to be the immediate cause of colony collapse, many entomologists believe some such disaster was waiting to happen: the lifestyle of the modern honeybee leaves the insects so stressed out and their immune systems so compromised that, much like livestock on factory farms, they’ve become vulnerable to whatever new infectious agent happens to come along.

You need look no farther than a California almond orchard to understand how these bees, which have become indispensable workers in the vast fields of industrial agriculture, could have gotten into such trouble. Like a great many other food crops, like an estimated one out of every three bites you eat, the almond depends on bees for pollination. No bees, no almonds. The problem is that almonds today are grown in such vast monocultures — 80 percent of the world’s crop comes from a 600,000-acre swath of orchard in California’s Central Valley — that, when the trees come into bloom for three weeks every February, there are simply not enough bees in the valley to pollinate all those flowers. For what bee would hang around an orchard where there’s absolutely nothing to eat for the 49 weeks of the year that the almond trees aren’t in bloom? So every February the almond growers must import an army of migrant honeybees to the Central Valley — more than a million hives housing as many as 40 billion bees in all.

They come on the backs of tractor-trailers from as far away as New England. These days, more than half of all the beehives in America are on the move to California every February, for what has been called the world’s greatest “pollination event.” (Be there!) Bees that have been dormant in the depths of a Minnesota winter are woken up to go to work in the California spring; to get them in shape to travel cross-country and wade into the vast orgy of almond bloom, their keepers ply them with “pollen patties” — which often include ingredients like high-fructose corn syrup and flower pollen imported from China. Because the pollination is so critical and the bee population so depleted, almond growers will pay up to $150 to rent a box of bees for three weeks, creating a multimillion-dollar industry of migrant beekeeping that barely existed a few decades ago. Thirty-five years ago you could rent a box of bees for $10. (Pimping bees is the whole of the almond business for these beekeepers since almond honey is so bitter as to be worthless.)

In 2005 the demand for honeybees in California had so far outstripped supply that the U.S.D.A. approved the importation of bees from Australia. These bees get off a 747 at SFO and travel by truck to the Central Valley, where they get to work pollinating almond flowers — and mingling with bees arriving from every corner of America. As one beekeeper put it to Singeli Agnew in The San Francisco Chronicle, California’s almond orchards have become “one big brothel” — a place where each February bees swap microbes and parasites from all over the country and the world before returning home bearing whatever pathogens they may have picked up. Add to this their routine exposure to agricultural pesticides and you have a bee population ripe for an epidemic national in scope. In October, the journal Science published a study that implicated a virus (Israeli Acute [Paralysis](http://health.nytimes.com/health/guides/symptoms/muscle-function-loss/overview.html?inline=nyt-classifier) Virus) in Colony Collapse Disorder — a virus that was found in some of the bees from Australia. (The following month, the U.S.D.A. questioned the study, pointing out that the virus was present in North America as early as 2002.)

“We’re placing so many demands on bees we’re forgetting that they’re a living organism and that they have a seasonal life cycle,” Marla Spivak, a honeybee entomologist at the [University of Minnesota](http://topics.nytimes.com/top/reference/timestopics/organizations/u/university_of_minnesota/index.html?inline=nyt-org), told The Chronicle. “We’re wanting them to function as a machine. . . . We’re expecting them to get off the truck and be fine.”

We’re asking a lot of our bees. We’re asking a lot of our pigs too. That seems to be a hallmark of industrial agriculture: to maximize production and keep food as cheap as possible, it pushes natural systems and organisms to their limit, asking them to function as efficiently as machines. When the inevitable problems crop up — when bees or pigs remind us they are not machines — the system can be ingenious in finding “solutions,” whether in the form of antibiotics to keep pigs healthy or foreign bees to help pollinate the almonds. But this year’s solutions have a way of becoming next year’s problems. That is to say, they aren’t “sustainable.”

From this perspective, the story of Colony Collapse Disorder and the story of drug-resistant staph are the same story. Both are parables about the precariousness of monocultures. Whenever we try to rearrange natural systems along the lines of a machine or a factory, whether by raising too many pigs in one place or too many almond trees, whatever we may gain in industrial efficiency, we sacrifice in biological resilience. The question is not whether systems this brittle will break down, but when and how, and whether when they do, we’ll be prepared to treat the whole idea of sustainability as something more than a nice word.

*Michael Pollan is a contributing writer. His new book, “In Defense of Food: An Eater’s Manifesto,” will be published next month.*