POST-PASTEURIAN CULTURES: The Microbiopolitics of Raw-Milk Cheese in the United States

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People in the United States live in a Pasteurian world. Many blame colds on germs, demand antibiotics from doctors, and drink ultra-pasteurized milk and juice, while politicians on the campaign trail slather on hand sanitizer. Yet there are post-Pasteurians in their midst: dissenters who insist that not all bugs are bad, not only that microbes are a fact of life but that many also enhance human life. Resisting the hyperhygienic dream of Pasteurians, post-Pasteurians might be concerned about antibiotic resistance, may embrace the naked handshake as a populist virtue (like Democratic presidential hopeful Bill Richardson [Leibovich 2006]), or may fashion informal social-economic channels to procure unpasteurized milk (Altiok 2006; Johnston 2006). Others produce, or pay premium price for, the gustatory and enzymatic richness of raw-milk cheese—the ethnographic object of this article.

In the last decade, new, handcrafted U.S. cheeses have mushroomed at farmers' markets, at restaurants, and in the media (Ogden 2007; Roberts 2007; Tewksbury 2002; Werlin 2000). Membership in the American Cheese Society, a not-for-profit organization of artisan and specialty producers, retailers, distributors, a few dairy scientists, and food writers, has increased exponentially in recent years. According to Jeff Roberts, author of *The Atlas of American Artisan Cheese* (2007), which profiles 345 small producers from Maine to Hawaii, the number of artisan cheese makers nationwide has doubled since 2000 (personal communication, August 2, 2007). More and more of the new U.S. cheeses are made from raw, unpasteurized milk.[1] Boosters hope that niche marketing, with "raw milk"

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and "artisanal" joining "organic," might make cheese making a value-adding strategy that can save small dairy farms. Vermont dairy farms numbered 3,216 in 1983, the year the American Cheese Society was founded; by 2003, only 1,459 remained.[2] Some of the most visible artisan cheese makers are early retirees launching a second career with capital earned in lucrative professions (business, law) or are young adults setting out to practice the lessons of sustainable development and critiques of global agribusiness learned in liberal arts colleges. These producers tend to make high-end table cheeses that might sell in urban markets for as much as $27 a pound (retailers generally double wholesale prices). Many of the most experienced artisans are former hippies or back-to-the-landers who for decades have been crafting farmhouse cheese for local markets and now suddenly find themselves part of a new "movement." A growing number of farmstead cheese makers are dairy farmers who turn raw, sometimes organic milk into Cheddar, Gouda, Jack, Feta, and other "everyday" cheeses that retail between $9 and $14 a pound (Paxson 2006). Not all artisanally produced cheeses appeal strictly to elite tastes and privileged incomes.

All cheese producers face restrictions on getting raw-milk cheese to U.S. markets. By U.S. law (21CFR133.182), cheese made from raw milk must be aged at least 60 days at a temperature no less than 1.7°C (35°F) before being sold or imported. The 60-day rule means to offer protection against pathogenic microbes that could thrive in the moist environment of a soft cheese. While the Food and Drug Administration (FDA) views raw-milk cheese as a potential biohazard, riddled with bad bugs, aficionados see it as the reverse: as a traditional food processed for safety by the action of "good" microorganisms—bacteria, yeast, mold—on proteins found in milk.

This article proposes a theoretical frame for understanding current debates over the gustatory value and health and safety of raw-milk cheese in the United States, debates that open into what Sidney Mintz identifies as a conundrum of democratic capitalist societies: "how to provide protection to the citizenry on one hand, yet maintain freedom of choice on [the] other" (2002:27). I introduce the notion of *microbiopolitics* to call attention to the fact that dissent over how to live with microorganisms reflects disagreement about how humans ought live with one another. Microbiopolitics is one way to frame questions of food ethics and governance.

If Foucault (1978) has argued that the 19th century saw the rise of *biopolitics,* the fashioning of new categories of persons to facilitate the statistical measurement and rational management of populations, largely via sex and reproduction, Bruno Latour, in *The Pasteurization of France* (1988), tracks a parallel history, describing the

accommodation of microbial life into the very constitution of this social field. Prior to Pasteur, Latour writes, Europeans had thought that butchers sold only meat, but then they discovered salmonella hitching a ride. It had been thought that birth involved but three players—midwife, mother, infant—but other agents were found to be present (Latour 1988:35). Latour argues that with microbes revealed to be controlled, hygienists, government officials, and economists laid the groundwork for what they believed to be "pure" social relations—relations that would not be derailed by microbial interruption, that could be predicted and thus rationally ordered. Biopolitics, then, is joined by *microbiopolitics*: the creation of categories of microscopic biological agents; the anthropocentric evaluation of such agents; and the elaboration of appropriate human behaviors vis-à-vis microorganisms engaged in infection, inoculation, and digestion.[3]

Pasteurian practices configure microbes as elements to be eliminated so that human polities might be cultivated. In addition to commercial food safety standards for refrigeration, pasteurization, and irradiation, examples include mandatory childhood vaccination (first developed to combat anthrax in cattle [Salmon et al. 2006]) and waterborne disease eradication (Nelson 2005). There is much to be commended in such public health programs. Raw milk can harbor the human pathogens *Salmonella, Lysteria monocytogenes, Staphylococcus aureus,* and *Escherichia coli*. Still, there are gaps in the hegemony of Pasteur's "germ theory." Although no one is suggesting overthrowing the FDA—a safe food supply is not to be underestimated—a curious mix of political libertarians and foodies is questioning some of the motives and logics underpinning the Pasteurian food regime. Raw-milk activist and naturopathic physician Ron Schmid characterizes Pasteurian microbiopolitics this way: "Pasteur's mechanistic understanding of disease took away the individual's power to prevent it, and placed the mandate to cure squarely in the hands of the medical professionals" (2003:46). For Schmid, the "individual's power" to prevent illness from raw milk consumption includes not only careful production practices—milk from small herds of grass-fed cattle that never see a feed lot, for instance—but also the cultivation of diverse intestinal flora and fauna that could enable the consuming human body to protect itself from disease. Whereas Pasteurianism in the realm of food safety has suggested a medicalization of food and eating, post-Pasteurians want to invest in the potentialities of collaborative human and microbial cultural practices.

The revival of artisan cheese making in the United States, especially of aged raw-milk cheese, provides a window onto social and regulatory negotiations of a hyperhygienic Pasteurian social order (as forwarded by the FDA) and a

post-Pasteurian microbiopolitics. If Latour's Pasteurians recognized microbes as fully enmeshed in human social relations, legitimating the hygienist's right to be everywhere, these post-Pasteurians move beyond an antiseptic attitude to embrace mold and bacteria as allies. In the post-Pasteurian ethos of today's artisanal cheese cultures—recognizing microbes to be ubiquitous, necessary, and, indeed, tasty—microbiopolitics is newly productive of modern craft knowledge and expanded notions of nutrition. It produces new materials (microbes) for thinking about conjunctures of cultural tradition and agrarian landscapes, along the lines of what the French call *terroir* (see Barham 2003; Trubek 2005). And it creates new alliances among cheese makers and among farmers, scientists, merchants, and foodies. In 2000, the American Cheese Society joined with Oldways Preservation and Exchange Trust to form the Cheese of Choice Coalition, dedicated to protecting Americans' right to eat raw-milk cheese. Through such networks, raw-milk cheese becomes legible as part of an alternative agrofood movement that works through "support for an alternative technology and/or product, as well as associated policies, production practices, and research programmes, that generally involves both a mobilization of civil society organizations and the formation of alliances with private sector organizations" (Hess 2004:494). Whereas Pasteurianism creates in citizens expectations that the state will ensure a safe food supply, such that "food panics" throw into doubt "the state's ability to regulate business and bodies" (Dunn 2007:36), post-Pasteurianism questions whether state regulators have only the interests of citizen-consumers at heart.

Microbiopolitics, then, is not about using molecules as metonyms for individual or population characteristics (race, disability).[4] Rather, it concerns the recognition and management, governmental and grassroots, of human encounters with the vital organismic agencies of bacteria, viruses, and fungi. Placing microorganisms such as bacterial cultures and cheese mold at the center of accounts of food politics can show us how public understandings and appropriations of scientific knowledge are reshaping how people think about food, its production, its nutritional and cultural value, and the regulation of its safety (e.g., Nestle 2003). This approach extends the scaling of commodity-network analyses in agrofood studies beyond global–local trajectories (Barndt 2002; Friedberg 2004; Jarosz 2000) and into the body, into the gastrointestinal. Philosophers of biology Maureen O'Malley and John Dupré have written, "We believe that an indefensible focus on macrobes [multicellular eukaryotes] has distorted several basic aspects of our philosophical view of the biological world" (2007:156). I suggest that neglect of the microbe (any organism, in the singular, invisible to the naked human eye) continues to

distort our anthropological view of the social world. If philosophical attention to microbes—and more, to how microbes and humans have been companion species (cf. Haraway 2003)—might "lead to a better understanding of how human health, disease resistance, development and evolution have depended and continue to depend on interactions with microbes" (O'Malley and Dupré 2007:158), then anthropological attention to microbes might lead to better understanding not only of certain human cultural artifacts—"natural" foods, for instance—but ultimately of the central object of our study: *anthropos,* the human "itself."

In this article, I outline some ways cheese makers, state regulators, academic consultants, and consumers negotiate Pasteurian and post-Pasteurian attitudes about the microbial bodies at the heart of raw-milk cheese. I draw on interviews with over 30 cheese makers and purveyors in New England as well as ongoing participant-observation research. In July 2005 and August 2007 I attended the annual meetings of the American Cheese Society, in Louisville, Kentucky, and Burlington, Vermont, respectively. In March and again in July 2007 I participated in two-day cheese-making workshops in Vermont run by cheese maker and consultant Peter Dixon. The real armature for this article, however, is built around fieldwork I conducted in May–June 2004, helping to produce one of the most celebrated U.S. cheeses, Vermont Shepherd, an award-winning Pyrénées-style raw–sheep's milk cheese (see Figure 1). I worked for two weeks as resident anthropologist on Major Farm in Westminster West, Vermont, helping in all facets of this raw-milk cheese production, from making pasture, to milking sheep, to making cheese, to *affinage* (the curing of cheeses as they age).

The narrative that follows reflects the state of Major Farm when I was there, in spring 2004 (the division of labor and employees have since changed). I interleave my ethnographic story with exegeses of key microbiopolitical moments in the coming into being of this raw-milk cheese. I examine claims about taste and place that may (or may not) follow from a microbial understanding of cheese. Then, taking up the dietary recommendation that pregnant women avoid raw-milk cheese, I extend feminist critiques of the medical-moralization of pregnancy (Oaks 2000; Rapp 1999) to explore how raw-milk cheese encounters U.S. risk culture. Finally, I consider how, for many cheese makers, the solution to safe and healthy raw-milk cheese is fully enmeshed in economies of scale and tied to agropolitics. This suggests a political-economic connection between "proper" cheese and "local" place, one nevertheless still threaded through microbes. In exploring through the story of Vermont Shepherd the productive force of microbiopolitics, examining reconfigured ideas about taste, place, nutrition, and production, I remain mindful

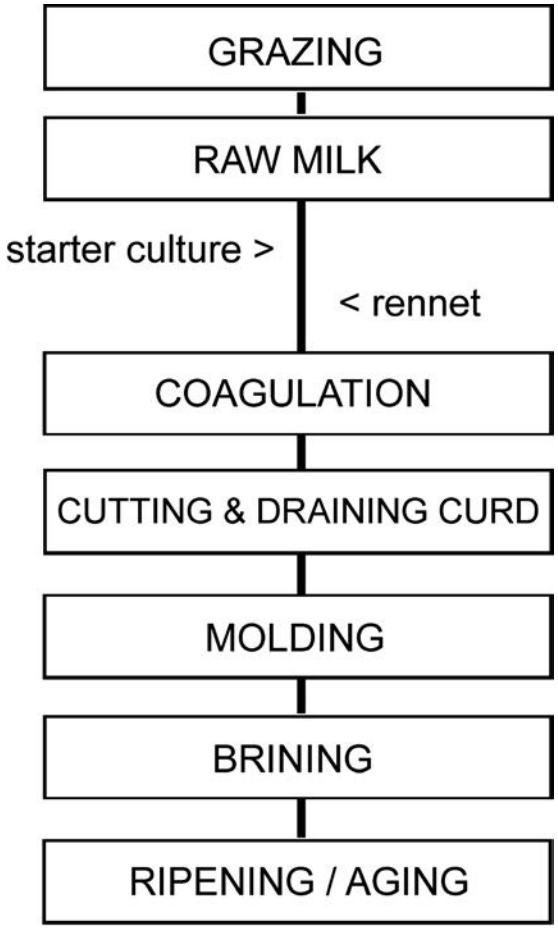

FIGURE 1. Basic steps in making Vermont Shepherd cheese (read from top to bottom).

of how producers of a post-Pasteurian food still engage a revised Pasteurian ethos as they work to secure a safe food supply by helping good bugs triumph over bad.

MAKING VERMONT SHEPHERD 1

David Major shepherds his dairy sheep—descendants of animals that his family raised for meat, wool, and pets when he was growing up—between pastures arrayed across three properties. Now in his mid-forties, David grew up in the farmhouse where his parents still live (they had off-farm careers in education and politics), across the road from where, in the 1980s, he and his first wife, Cindy, built their house, Major Farm. After struggling in the wool business, David and Cindy started

milking the sheep and learned to make cheese, first through trial and error and then by apprenticing with Basque shepherds in southern France. Most of the sheep in 2004 lived on a neighboring farm that Cindy's parents bought after Vermont Shepherd showed signs of fulfilling David's dream of earning a living by working this land. I was invited to stay in the unheated barn apartment on this third property, in a sparsely furnished room where David sleeps at the height of lambing season, making himself available to assist ewes in difficult middle-of-the-night deliveries. Each morning at 6:00 I am wakened by the sound of bleating sheep trotting into the adjacent milking parlor.

After pitching in with the two-hour morning milking of 130 ewes, I meet David in the cheese house. I am outfitted with hygienic gear that never leaves the cheese room: knee-high rubber boots, a long white plastic apron, a white baseball cap, and surgical gloves that fill with water when I sterilize milk cans. Later, an established cheese maker in Massachusetts tells me he thinks he has solved a long-standing problem with consistent quality in one of his cheeses by noticing that he and his crew were "not being scrupulous about footwear in the make room"; his wife's shoes, he suspects, were tracking bacteria from barnyard to cheese house. Now, he says, "boots and shoes in the make room stay in the make room"—a practice the Majors follow.

David begins with a ritual testing of the milk for the presence of antibiotics. Antibiotics in milk, from veterinary treatment of animals, would kill off the good bacteria necessary for fermentation. Because they could also cause allergic reactions in consumers, their presence would make the cheese illegal to sell. David records the results on a clipboard by the door "for the inspectors." This is largely a matter

Pasteurization

Pasteurization is a time–temperature relationship. To kill off pathogenic (and benign) microorganisms naturally residing in milk, the liquid can be heated at 72°C (162°F) for 15 seconds (high temperature, short time; or "flash pasteurization") or held at 63°C (145°F) for 30 minutes ("vat pasteurization"). Small-scale artisan cheese makers who pasteurize their milk (such as makers of fresh cheese, like chèvre) generally follow the latter formula. A compromise between pasteurizing and not heat-treating milk at all is called *thermizing* and involves bringing milk up to 55°C (131°F) for 2 to 16 seconds. Whereas in France thermizing is considered a heat treatment that distinguishes thermized milk from raw milk (as revealed in recent controversy over an announcement by one of the few remaining producers of *lait cru* Camembert, Lactalis, that it will thermize most of its Camembert milk [Sciolino 2007]), the U.S. FDA classifies thermized milk as "unpasteurized" (i.e., in the same category as raw milk).

of form. David uses antibiotics only for deworming, and animals undergoing such treatment are removed from the milk supply. State-mandated testing for antibiotics, even at organic farms, is a sign of our microbiopolitical times, a one-size-fits-all response to industrial agriculture's overuse of antibiotics to keep livestock alive, a practice that has pushed pathogenic bacteria to charge back at us with ever stronger, more resistant strains.

While whole, raw milk from yesterday evening's milking heats gently in a vat, I whisk a powdery "starter culture" of freeze-dried *Lactobacilli* bacteria into a pail of this morning's milk, still warm from animal bodies (73–83°F). These bacteria contribute to the flavor, consistency, and identity of a cheese. Selected from benign natural residents in milk, such starter cultures can outcompete harmful pathogens and are crucial agents in producing a food safe for human consumption. Most fundamentally, starting the fermentation process, called *acidification,* by which milk becomes cheese, the bacteria feed on lactose, producing lactic acid as a waste product.

In the 19th century, scientists at the Pasteur Institute in France established that the seemingly magical process of curdling and cheese ripening is not "spontaneous" but, rather, the outcome of microbial agents at work. They isolated and cultivated strains of the *Penicillium* family *(P. candidum)* responsible for lactic acidification and the formation of edible mold. By century's end researchers convinced French cheese makers to impose science on the fate of their cheeses by seeding them with commercial, laboratory-made "starter" cultures. These Pasteurians, according to Pierre Boisard (2003), wanted not to displace the cheese makers but, rather—as with the hygienists of whom Latour writes—wished to aid cheese makers in their work of turning out a reliable product that could travel into a distributed market.

Commercial cultures enabled the industrialization of cheese. Because pasteurization, a time–temperature relationship, kills 95 percent of all bacteria in fresh milk, pasteurized milk must be re-seeded with pure cultures to start the process of acidification. In an 1892 issue of *Science,* Wesleyan University biologist Herbert Conn predicts that microbial seeding would lead to a larger, safer cheese supply. Describing the common invasion of cheese by pathogenic microbes, Conn speaks in canonically Pasteurian terms: "The cheese manufacturer is entirely innocent. . . . But occasionally [these tyrotoxicons] get in and his cheese is ripened . . . under the agency of these injurious bacteria. . . . [T]he evil is done. Now, when our cheese-makers have learned to apply to the manufacture of cheese the processes

which our brewers have learned in the manufacture of beer, these troubles can be prevented" (1892:260–261). When David Major, heir to this scientifically minded praxis, makes cheese, he seeds raw milk with bacteria cultured in a French lab, Enzyme Analogue Lactic (EZAL), to ensure a reliably consistent and safe product (if David pasteurized his milk, he would have to use about double the quantity of commercial cultures). Every couple of weeks he alternates strain mixtures—EZAL 4001 and 4002—to maintain microbial variety in the cheese room and outwit lurking pathogens.[5]

More than a century ago Conn anticipated two industry advantages from pure starter cultures: safety and variety. Noting that each of 400 or 500 known species of bacteria produces "different sorts of decomposition . . . odors and . . . flavors," he speculates that microbial seeding could lead to 400 or 500 kinds of cheese: "Perhaps fifty years from now . . . a man may go to the store and order a particular kind of cheese . . . made by a peculiar kind of bacteria" (1892:260). Of course the story of 20th-century industrialization is that it produced uniformity and not the gastronomic variety of which Conn dreamed. But this is where today's post-Pasteurians hope to write a new chapter. They seek to rescue indigenous cultures—microbial but also human—from industrial homogeneity.

MICROBIOPOLITICS 1: LINKING TASTE AND PLACE

As commercial cultures proliferate, indigenous cultures may be dwindling. Writing of French cheese making, a team of U.S. and French microbiologists warn in *Applied and Environmental Microbiology,* "The industry trend toward standardization of inocula and ripening conditions may lead to the loss of empirically derived biodiversity" (Marcellino et al. 2001:4753). The researchers have isolated and characterized 64 distinct strains of the microbe *Geotrichum candidum* from seven cheese-making regions in France. This is the diversity David Major tries to replicate by alternating EZAL strains.

The lead author of the article, Mother Noella Marcellino, popularly known as the "Cheese Nun," inaugurated the salvage cheese-profiling effort on a Fulbright and leave of absence from her Connecticut abbey, during which she traveled the French countryside, turning up in her habit at cheese-making farms, asking to collect a bit of their milk, curd, and cheese and to scrape microbial samples from the walls of their facilities. She writes, "As traditional cheesemaking techniques are threatened or have been abandoned, the collection, characterization, and preservation of native strains of cheese-ripening microorganisms are critical"

(Marcellino et al. 2001:4758). Marcellino has made it her mission to better understand how microbial strains and cheese-making practice are coproduced.

As she explains in her 2003 Ph.D. dissertation, Marcellino became curious about cheese microbiology after 20 years' experience making Bethlehem, a raw-milk, surface mold–ripened cheese, in her Benedictine abbey. To make Bethlehem, Marcellino (2003:51) follows a traditional French recipe taught to her by a third-generation cheese maker from the Auvergne. Like Pasteur Institute scientists a hundred years previous, Mother Noella observed that the spontaneous appearance of fungi on her natural-rind cheese seemed to be "reproducible and predictable" (2003:30), even though her cheese relies wholly on environmental microflora (she does not use bacterial or fungal additives). Unlike the Pasteurians, the Cheese Nun was curious to learn the identity of indigenous microflora to preserve them as they are; she has no interest in trying to improve on them in a lab.

Marcellino regards biodiversity as having historical and cultural value. As she says in Pat Thompson's 2006 PBS documentary, *The Cheese Nun,* "Just as you want to save a certain kind of tree in the rain forest, you want to save the microbes that are part of a region, because they're the ones that have contributed to the flavor and special unique character of a cheese." There is a glimmer here of *terroir,* the viticultural term increasingly used to describe a sense that climate and soil create distinctive pastures that generate flavor components transmitted to milk and are reflected in artisanal cheese. Unlike industrial cheeses made from heat-treated milk pooled from perhaps hundreds of dairies and not given time to mature, artisanal raw-milk cheeses, some retailing for well over $20 a pound, can, according to connoisseurs, express the complexities of "terroir taste" (Binchet 2002; McCalman 2002; Style 2006). In 2003, the U.S. branch of the international eco-gastronomic Slow Food movement inaugurated the American Raw Milk Farmstead Cheese Consortium to support cheeses made from unpasteurized milk on the same farm as the animals that produced the milk, suggesting that these cheeses—more than others—"reflect the connection between the land, the animals, and the cheesemaker."[6] Just how this happens remains something of a mystery. One cheese maker at the 2005 American Cheese Society meetings described cheese making as "capturing a procession of flavors that are rooted in the grass" through a "dynamic process I don't pretend to understand."

In her thesis, Marcellino quotes French cheese master Pierre Androuët as writing, "Our predecessors thought with reason that the natural agents in the environment conditioned the personality of cheese and marked them with the

indelible sign of vintage and territory" (2003:64). The possibility of cheese terroir raises important questions of geographical coherence (how is one "place" differentiated from another?), histories of land use, taste education, marketing, and so forth. Marcellino's question is whether Androuët's "natural agents" include microbes; my question, in this article, is: Is there a role for microbes—and microbiopolitics—in thinking through links between land and food, place and taste?

Noting similarities "in the surface appearance, flavor, color and texture" between her Bethlehem cheese and traditional Saint-Nectaire, a state name-controlled (Appellation d'Origine Contrôlée) cheese of the Auvergne, Marcellino wondered whether it was also the case that they resembled one another microbially (Marcellino and Benson 1992:3448)—a provocative question because both cheeses are made without commercial starter cultures or secondary inoculations. Knowing that the yeast-like fungus *Geotrichum candidum* is crucial to a cheese's ripening and sensorial character, Marcellino tested this hypothesis: "that diversity of *G. candidum* is a function of the geographic region from which the isolate was obtained and/or the class of cheese from which the isolate was taken" (2003:26). That is, are specific strains emergent from environmental conditions, craft technique, or a hybrid of the two?

When she sequenced the DNA of *G. candidum* collected from the seven regions in France, Marcellino discovered no correlation "between the regions from which strains were isolated and clustering patterns," concluding that "similar or identical strains are ubiquitous throughout France and probably the world" (similar strains turned up in her Connecticut cheese [Marcellino et al. 2001:4756]). Insofar as French cheeses owe much of their distinction to the work of microbes, this microbial "patrimony," as she calls it, lies not in the spontaneous appearance of regionally distinct yeasts and molds crucial for cheese ripening. Put starkly, we are not talking, à la Rabinow (1999), of French DNA. When David Major put French freeze-dried microbes in his Vermont Shepherd, this did not make it a French cheese.

Technique, Marcellino suggests, is a stronger influence than geographical region on microbial development in cheese. Microbiologically, she describes artisanal cheese as a nature–culture hybrid: the microorganisms that seed France's most established cheeses cling to the walls of preindustrial cheese houses and underground ripening rooms following decades, if not centuries, of consistent craft practice, often based on family recipes. Marcellino, like Latour, points to the social character of microbes: natural flora and fauna, they materialize as specific communities within ecologies of human practice. To speak doubly of cheese cultures—bacterial and human—is thus no idle pun.

Still, in the documentary, Marcellino announces that "the diversity of the local strains of microorganisms in a region contributed to the diversity of cheeses in France. . . . So you may not think that microorganisms are important, but . . . for the French, they consider this, these microorganisms, part of their patrimony" (Thompson 2006). Aware that France and the European Union are invested in the idea that place matters to foods, Marcellino leaves open the possibility that terroir might yet be meaningful for cheese: "If one faithfully follows a traditional technique based on a natural microbial succession, one is able to create a new product characteristic of one's own land" (2003:65).[7] One cheese maker with whom I shared this argument suggested that, although strains of cheese mold might be selected for by technique, populations of bacteria naturally present in milk might well cluster meaningfully within particular geographies. In my view, a further possibility is that, if not from uniquely indigenous microbes, terroir taste could be understood to result from bacteria breaking down enzymes in milk, releasing when they die chemical flavors originating in local grasses. Here, the culturing of cheese recalls the etymology of culture—reaching back to cultivation—as traced by Raymond Williams (1985). David told me that if a sheep eats a stray thistle, you taste it in the cheese made from that day's milk; Marcellino attributes this, at least in part, to the metabolizing work of microbes. So, microbial claims to cheese terroir would lie not in who microbes are taxonomically (what Conn hypothesized in 1892) but in what they do metabolically. Such a view might also suggest stronger claims for a "terroir effect" in cheese made from raw, as opposed to pasteurized, milk (Brunschwig et al. 1999). Microbiopolitically, raw-milk cheese might be forwarded as a *biotechnology* (derived from the scientific use of living organisms or parts of organisms) for regionalism or, in more contemporary argot, for localism, the expression of a people's connection to a piece of land.

MAKING VERMONT SHEPHERD 2

Once the milk reaches a uniform temperature between 70 and 80°F, David stirs in rennet, added in dilute solution with a couple quarts of cold tap water. Rennet is an enzymatic agent used to facilitate the second key chemical process in cheese making after acidification: curdling, the coagulation of milk into curd. After England's mad cow (bovine spongiform encephalopathy) disease scare, David uses a mold-derived (microbial) rennet rather than the standard substance extracted from the lining of the fourth stomach of suckling ruminants, which he used to import from England (commercial animal rennet is a by-product of the veal industry). In England, vegetarians often seek out cheese from mold-derived—also called

"vegetable"—rennet; David said "vegetarian" rennet is not much of an issue in the United States (at least for consumers of high-end table cheese). His other option would be a genetically modified version, but this, he said, does raise questions among some consumers. Choice of rennet, along with the alternation of starter culture strains, reflects cheese makers' suppression of some microorganisms to facilitate the flourishing of others and their constant consideration for various hosts that microbes connect: land, animal, milk, cheese, human.

About 12 minutes after adding rennet, the milk hits the flocculation point—from one second to the next it suddenly thickens. In 30 minutes the curd is fully set. As David cuts the soft curd into centimeter cubes to drain out whey, I reach in for a taste—it is sweet, rich, custardy. Stirring constantly, David cooks the curd at 101°F (well below pasteurization temperature) for 30 minutes. I help consolidate the now rubbery "cooked curd" into a solid mass, bailing out whey, full of protein and bacteria, which will go to fertilize pastures. David cuts the curd into 32 blocks, each of which we repeatedly knead and mold in plastic bowls that give Vermont Shepherd its distinctive form. My arm muscles are already sore from lifting 10-gallon milk cans in and out of soapy water, and I think to myself that "hand crafted" is no mere metaphor. I wheelbarrow the fresh cheeses a few hundred meters to the cheese cave, fashioned from repurposed concrete culverts sunk into a hillside, where they will drain overnight.

The next day at the cave, I join my barn mate Lucy, the Majors' seasonal intern and a recent Smith College graduate, to begin the work of brining. No salt has been added to the curd, but salt, an antibacterial agent, is important to the future of these cheeses. We weigh each cheese to determine how long, between 24 and 36 hours, it will float in the salty, microbially rich brine bath that is used all season long. The cheeses dry out on wooden boards until, in about a week, they "hit puberty," as David says to me, and a gentle white mold begins to grow on their surface, resembling a sprinkling of baby powder.

Vermont Shepherd is a "natural-rind" cheese, its outer surface hardened by exposure to air. A natural rind is not simply dried out; it is the result of carefully nurtured biochemical reactions—basically, controlled rotting or what Lévi-Strauss (1968) in his attempt at a universal culinary syntax might call the cultural elaboration of the raw by natural means. Twice a week, gloved fingers dipped in brine, carrying salt, moisture, and scores of species of bacteria, gently press a newly accumulated microbial bloom into the cheese to build up a semipermeable crust that allows gasses and moisture to escape. Rinds that can be up to 20 percent salt protect the interior from pathogens while nurturing "good" microbes, such as the sharply

aromatic *Brevibacterium linens,* that contribute to an aged cheese's complex flavor (*Brevibacterium linens* is closely related to *Brevibacterium epidermis,* native to the "warm, humid clefts between human toes" [Enserink 2002:90]). Maria Trumpler, who makes a natural-rind cheese, Vermont Ayr, later assured me, "It's the bacteria who do all the work of making the cheese—they make the flavor, they make the texture. All we have to do is not get in their way." I work with Nicholas, the assistant farm manager, in what is simplistically called "turning" the cheeses. Later, my throat and lungs feel irritated, and I have a shallow cough. David tells me he does little of the curing because he is allergic to mold. The next time I help Nicholas I wear a protective mask. The intensive human labor that goes into a "natural"-rind cheese exemplifies microbiopolitics as a productive force, with calculation, classification, and cultivation working hand in glove.

Wheels of Vermont Shepherd are cured in this way for at least three and a half months, a month and a half beyond the legal minimum, before being released on the market. At this point, the rind has grown hard and brown, and the interior paste has become smooth and toothsome. The mandatory aging period is meant to "provide a measure of pathogen reduction" (National Research Council 2003:234), the idea being that the drying and acidification associated with aging would prove increasingly inhospitable to pathogens. David offered me an additional rationale: if something is wrong in the cheese, by 60 days it will become apparent, through explosions of gas bubbles, malodor, or other organoleptic signs.

MICROBIOPOLITICS 2: LINKING INFECTION AND DIGESTION TO POLITICAL ECONOMIES OF SCALE

Pasteurian regulatory practices work not only to produce safe food: they also work to cultivate germophobic subjects who will make rational decisions to safeguard their health. Although the mandatory aging period for raw-milk cheeses originated with standardized rations shipped to World War II servicemen, the FDA now directs its sternest warning about cheese-residing microbes at pregnant women, advising them until recently to avoid all blue-veined and "soft" cheeses, "like Feta, Brie, and Camembert," regardless of aging or pasteurization.[8] The fear is *Listeria monocytogenes,* the microbe behind listeriosis, which has been linked to miscarriage and stillbirth. Note that the category "soft" is neither self-evident nor used in the cheese world but is meant to encompass young cheeses with high moisture content conducive to bacterial infection. Owing to categorical vagueness—and perhaps to the unctuous liminality of a supple cheese with guilt-inducing consumptive pleasure—the warning has caused considerable

confusion among the microbiopolitical players the FDA intends to serve: at-risk consumers.

Women post agitated queries and misinformation in online discussion forums. Some samples from babycenter.com include the following:

> Are soft pasteurized mozzarella and cheddar cheese spreads okay to eat? I am confused because cheese spreads are "soft."
>
> SC June 13, 2005
>
> I was at a gourmet grocery store and asked the cheese question. The workers said that all cheese that is imported has to be pasteurized. It is a legal issue. Hence, I wouldn't worry about it.
>
> Sara October 23, 2005
>
> I did not know that Muenster cheese was considered a "semi-soft" cheese! I am only 8 weeks pregnant, but I have been eating it every day for the past week! Do I need to be concerned?
>
> Anonymous January 6, 2006
>
> My doctor told me that the cheeses that smell are basically the ones to avoid—feta, bluecheese, brie; most soft cheeses do have a strong scent.
>
> Anonymous March 2, 2006
>
> I've read many things that warn against soft cheese, but none of them explain what the soft cheeses are!!!
>
> Whitney M. July 4, 2007[9]

The confusion is understandable. As Laury Oaks (2000) details in her study of smoking and pregnancy, women are asked to weigh abstract, often ill-explained or inconclusive science and statistics against personal and familial experience in deciding whether to follow, ignore, or compromise with medical advice. For myself, pregnant a year after my stay on Major Farm, the more I knew, the more confounded I became. "Sara" here is wrong that "all cheese that is imported has to be pasteurized"—only cheese aged fewer than 60 days must be. Nevertheless, I

knew high-end cheese shops sometimes manage to sneak in underage, unpasteurized cheeses, occasionally selling them as if they were the legal deal (my husband brought me illicit *lait cru* Brie de Meaux in the hospital the day after our son was born, given to him gratis by an understanding cheesemonger who explained, "We can't sell this stuff"). Then again, I also knew that the only outbreaks of listeriosis linked to "soft" cheese in the United States concerned *queso fresco* or other "Mexican-style" cheeses (Bren 2004; Linnan et al. 1988); one was traced to cheese sold door to door and apparently made in someone's bathtub (Donnelly 2004). I started eating Feta after learning that moisture content (indirectly measured in terms of "softness") is just one factor influencing the growth of pathogenic bacteria. Cheeses with a pH above 5.5 are more likely to harbor *Listeria* than cheeses with a lower pH. Taking acidity into account, Camembert, whose pH increases to 7.5 with ripening, is far riskier than Feta (pH 4.4), although both appeared on the FDA warning list. Learning more science added complexity—not always clarity—to my decisions about what to eat.

In August 2005, the FDA revised its recommendation to permit pregnant women "soft" cheese if the package states "made with pasteurized milk."[10] While this should clear up some confusion, it is far from a guarantee of health. It turns out that in the past decade about half the *Listeria*-contaminated cheeses discovered by the FDA from random testing or food-borne illness reports were made from pasteurized milk; these involved either postprocessing contamination (an improperly cleaned shredding machine is faulted in one case) or cheese made from industrial-scale quantities of horribly tainted milk that pasteurization could not redeem (Donnelly 2005). Although the new recommendation may be clearer to understand, it is no more rational from a public health perspective because when it comes to cheese, pasteurization—which kills off the "good" bugs with the bad—is not as rational a tool as Pasteurians might like to believe.

Nevertheless, just as new raw-milk farmstead cheeses like Vermont Shepherd—properly aged and hardened—started proliferating, the Pasteurians upped the ante: in the late 1990s the FDA's agenda included a safety review of raw-milk cheese aged *beyond* 60 days. The feds had learned of a South Dakota State researcher (and former employee of dairy giant Kraft Foods) who published a study in the *Journal of Food Protection* of the damage that might be unleashed by a new pathogen, *E. coli* 0157:H7—on the Centers for Disease Control list of bioterrorism agents and in the news most recently by way of bagged spinach and ground beef.[11] To claim that this *E. coli* could survive 60 days in raw-milk cheese, the researcher cites his own controlled lab experiment. The Cheese of Choice Coalition later

engaged University of Vermont microbiologist Catherine Donnelly, whose lab first isolated *Listeria monocytogenes,* to review the study. She (2005:184–185) reports that the controlled study used far less salt (that antibacterial agent) than would be added to cheese intended for consumption and began with a larger concentration of *E. coli*—which originates in cow intestines and spreads through manure—than could ever have slipped into artisan cheese making undetected. Following the premise of a reductionist science, the original researcher appears to have treated cheese as a chemistry experiment, not as food. In the end, that *E. coli* 0157:H7 survived in this lab cheese comes as no surprise—and was not the smoking gun the FDA thought it had.

Despite the flaws of this study and the fact that no epidemiological link has been made between pathogenic illness and aged raw-milk cheese, the FDA is still reevaluating the 60-day aging requirement "to determine if this process criterion is adequate to protect public health" (National Research Council 2003:226). A total ban on raw milk would spell death not only for cheeses like Vermont Shepherd but also for cheese makers like David Major who, even if they could afford a pasteurizer (a small vat pasteurizer retails at around $28,000), have developed market reputations for cheeses whose flavor and texture might be altered by pasteurization. Mandatory pasteurization for all cheese milk would also mean the end of imported Gruyère and English Farmhouse Cheddar—even, presumably, Parmigiano-Reggiano, a hard, dry cheese made from curd cooked to higher temperatures than required for pasteurization and which I heard Donnelly (2004) describe as microbially "bomb proof." Shortly after the FDA's intentions were announced, Steven Jenkins, author of the *Cheese Primer* and cheesemonger for Fairway supermarkets in New York, said to a *New York Times* reporter, "This whole thing is crazy. . . . It's going to wipe out one of the most beautiful and romantic links between human beings and the earth that we will ever know, and we are going to be the lesser for it" (Wakin 2000:B1). Rumor in the cheese world has it that, although a total ban is unlikely, the feds might yet extend the mandatory aging period to 120 days.

Are raw-milk cheeses, properly aged and made on an artisan scale, really riskier than industrially processed "soft" pasteurized ones? Although Robert, my local cheesemonger, erred on the side of caution in steering me during my pregnancy toward firm, pasteurized cheeses (there are excellent cheeses made from pasteurized milk), he believes it is no coincidence that in the years he has been eating raw-milk cheese he has not caught a cold or the flu. According to post-Pasteurians, for those who are neither pregnant nor immunocompromised, raw-milk cheeses

may actually be safer to eat than pasteurized ones, for what protects the cheese can protect us. The care of the self can be served by the care of the microbe, the cultivation of the "good" bug. Metabolites produced by Mother Noella's *G. candidum,* a fungus that colonizes nearly all surface-ripened cheeses, can inhibit *Listeria monocytogenes* (Marcellino et al. 2001:4752). Donnelly writes, "Mandatory pasteurization of milk may increase the susceptibility of cheese to growth of pathogens introduced via postprocessing contamination" (2005:191). For these post-Pasteurians, microbes are not the invisible enemy lurking in cheese; they are cheese. As one journalist puts it, "When you eat such a cheese, you are eating an evolving ecosystem. There are billions of bugs in every bite" (Kunzig 2001). What is more, microbially laden "real" cheese is claimed to be able itself to eradicate pathogens. Ironically, while the FDA is considering extending the raw-milk cheese ban, contract scientists for the meatpacking industry are testing the "probiotic" possibilities of feeding *lactobacillus* to beef cows in an effort to increase their resistance—and human exposure—to, say, *E. coli* (Dunn 2007:46). Cheese advocates, meanwhile, argue not only that raw-milk cheeses can be quite safe but that they are also healthier than pasteurized ones, full of minerals and B vitamins. Because they are rich in enzymes, raw-milk cheeses are said to be easier for humans to digest and, writes *maître fromager* Max McCalman, are "less likely to coat our arteries" (2002:62).

From a public health perspective, raw-milk cheese is less of a safety concern than raw eggs and oysters, processed meats, bean sprouts, or cigarettes. In a talk sponsored by the University of Vermont's Vermont Institute for Artisan Cheese in 2004, I heard Catherine Donnelly comment, "Science can't explain why the 60-day rule was reexamined." If the government demanded that all cheeses be pasteurized, it would be "felt around the globe," she noted, with huge consequences for international trade. One cheesemonger I interviewed in western Massachusetts is convinced that the FDA review reflects the "protectionism pressure" of big dairy; the National Cheese Institute, the dairy association whose 90 members collectively manufacture about 80 percent of cheese, process cheese, and cheese products in the United States, is reportedly lobbying for mandatory pasteurization of all cheese milk (Watson 2004).

Unlike what has happened with organic produce (Guthman 2004) and milk (DuPuis 2002), raw-milk cheese is a value-added food that many argue cannot be successfully absorbed by industry giants; at a scale larger than artisan, a farmer would have many people working for him or her, thereby losing direct control over production quality. The cheesemonger in Massachusetts mentioned a March 2005 recall of an artisan cheese made nearby from locally sourced raw milk after routine

FDA inspection of the cheese turned up *Listeria* (the FDA has a zero-tolerance policy for *Listeria monocytogenes*). The bulk of the milk that went into this cheese, the retailer told me, came from a farm with 300 cows—a herd, in his opinion, too big to do raw milk safely. Although *Listeria*, an environmental pathogen, is more likely to infect a cheese once it is made than originate in the milk cheese is made from (D'Amico et al. 2006), because *E. coli* originates in manure, that pathogen is closely linked to herd management.

Clean milk is essential to raw-milk cheese production. My tale of making Vermont Shepherd really should have begun at 6:00 a.m. in the milking parlor. Before affixing milking cups to each ewe, I joined Lucy in washing the teats and surrounding area of the udder with an iodine solution, wiping them clean with unbleached paper toweling. After milking each sheep, we again sprayed the teats with iodine solution to prevent infection. The sheep are watched closely for evidence of mastitis and other illness; infected animals are pulled from the herd and milked separately, by hand; the milk is then discarded.

Cheese makers I have interviewed take quite seriously the fact that they work with a potential biohazard. One in Massachusetts said to me about cleaning up: "I always thought about it as a chore. I'd give as little attention to it as I could, but it's really a science unto itself. If you want to properly clean a certain surface, you need so much percentage of soap and so many minutes—if you approach it like that, it's not so much cleaning up, it's doing something necessary and productive." Another cheese maker told me that "90 percent of quality cheese is cleaning up"; yet another volunteered a figure closer to 80 percent. Cleaning is productive of high-quality cheese because it enables the good microbes to win out over the pathogenic. Cleaning and hygienic footwear remain important throughout the manufacturing, aging, and packaging process, because the presence in foods of environmental pathogens such as *Listeria* results primarily from postprocessing contamination (D'Amico et al. 2006). Raw-milk cheese is not for these contemporary producers a "return to" or "invention of" tradition (Bromberger 2005) but, rather, a form of modern agriculture carried out under exceptionally sanitary conditions (one cheese maker I interviewed had previously worked as a dental hygienist; another, as an operating room nurse). Some cheese rooms I have seen resemble nothing so much as scientific laboratories.

Mateo and Andy Kehler, brothers who milk 35 cows and make raw-milk cheese in northern Vermont, voluntarily sent off a sample of every fourth milking (every other day) to a private dairy laboratory for microbial testing, at great expense (approximately $60 per test or "hundreds and hundreds of dollars a month"). At the

2005 American Cheese Society meetings, Mateo announced at a panel on working with raw milk that the bacteria count of the milk they make cheese from is generally lower than that of some pasteurized milk on supermarket shelves (a claim other small farmstead producers have made to me as well). To produce and maintain safe milk the Kehlers never feed their cows silage (fermented corn) or fermented hay, notorious bacterial breeding grounds; they never store milk beyond 24 hours; and they are scrupulous about hygiene from barn to cheese rooms.[12] Cheese makers, Mateo said, need to police themselves about safety. And for the most part they do. Still, recalls happen every year—and when they do, they are bad for everyone's business.

Aging cheese for 60 days—like pasteurization—is no guarantee of safety (D'Amico et al. 2006; Pritchard 2005). Cheese makers like the Kehlers are developing their own Hazard Analysis and Critical Control Point (HACCP) guides, which, they argue, are potentially safer than mandatory pasteurization—not to mention more economical and gastronomical. First developed in the 1970s to ensure the microbial safety of space food for NASA astronauts, HACCP is mandated by the U.S. Department of Agriculture for the meat and seafood industries; it works to identify and cut off what Latour might call "obligatory points of passage" for microbial contamination. It may seem simple, but the preventative approach marks a significant departure from standard dairy procedures reliant on spot inspections, random sampling, and "pasteurizing or irradiating products that may have been produced with varying attention to quality and safety" (Shillinglaw 2003). Whereas HACCP works to avoid (so far as possible) contamination in the first place, mandatory pasteurization assumes contamination is unavoidable but eradicable. For the FDA—and for industrial dairy—the Critical Control Point is pasteurization. But this need not be the case (Dixon 2000). Cheese type and scale of operation dictate the "critical control points" of cheese making. An HACCP plan for raw-milk bloomy-rind cheese would look quite different than one for Cheddar. This variation, along with the reams of paperwork that a state-regulated HACCP program would mandate (HACCP, as Dunn [2007] points out, operates as an audit system), makes most cheese makers reluctant to embrace legally binding HACCP programs. Instead, cheese makers think through critical control points in designing their facilities and in developing a general protocol for make procedures—guidelines that in practice must accommodate the vagaries of milk, a living substance whose protein content and chemical composition change seasonally with the lactation cycle of ruminants and the succession of flora in pastures.

At the 2005 American Cheese Society meetings, some producers argued that for safety reasons, raw-milk cheese should be restricted to farmstead operations, where milk is sourced from a single herd or flock, potentially providing the cheese maker direct oversight of milk production. Yet the farmstead designation does not control for scale; one farm in Modesto, California, milks 1,500 cows and produces 400,000 pounds of raw-milk farmstead Cheddar a year (Sakovitz-Dale 2006:14), a total approaching the 2005 farmstead cheese production for the entire State of Vermont, estimated at 475,000 pounds. Against those who consider scale a raw-milk safety matter, it can persuasively be argued that Cheddar (in this case) is a cooked-curd, long-aged cheese that is close to being microbially "bomb proof." I suggest, though, that an additional concern beyond safety is in play here. When producers like the Kehlers argue that raw milk production should be restricted to small-scale operations, they want to secure a symbolic connection between raw milk and small farms in hopes of convincing dairy farmers who can no longer make ends meet milking 50–70 cows to consider making cheese, without investing in a pasteurizer, as a means of sustaining their farms and revitalizing rural communities and economies. They want to see raw-milk cheese become a cornerstone of a "civic agriculture" (DeLind 2002; Lyson 2004).

MICROBIOPOLITICS 3: CHEESE, SEX, AND BEYOND

The microbiopolitical regime of the FDA, working to protect the health of an eating population, is guided by a science-based governmentality similar in some ways to the biopolitics of, say, safe-sex campaigns. There are important differences. While prophylaxis and vaccination trade in communicable diseases, food poisoning—although discomforting and occasionally lethal—is not contagious. But in their intimate, bodily yet social characters, food and sex, eating and eros, have much in common. As French sociologist Pierre Boisard writes of the iconically unctuous, mold-ripened, *Listeria*-friendly, unpasteurized version of a classic cheese: "Camembert, a living substance produced by an animal organism, constantly reminds us of the body, of sensual pleasure, of sexual fulfillment, and of all that is forbidden in it" (2003:220). Commenting on the U.S. ban on such cheese, he continues, "Hidden Puritanism is . . . reentering through the back door in the form of provisions purportedly aimed at alimentary hygiene. Now that it has been banished from the bedroom, the moral order is trying to get at us at the dining table" (2003:220). Boisard may overstate the Puritanism in U.S. governmentality (and understate it in the French; there, too, raw-milk Camembert is increasingly a rarity [Sciolino 2007]). I agree, however, that ethical subjectivity is at the center of

micro- and biopolitical struggles over food and sex. As I have argued in previous work, safe-sex and family-planning campaigns, in Greece and other democratic societies, aim at population management through rationalizing sex and encouraging subjects to "choose" prophylaxis as a modern virtue (Paxson 2004). In much the same way, dietary science counsels that food choice be governed by consideration for health, not pleasure in taste. A Pasteurian aesthetic and ethic of eating, hegemonic in industrial food worlds, proposes that eating well is eating safely and that good (moral, responsible) eating is safe eating.

Although the FDA may induce guilt in pregnant women, it cannot stop them from consuming soft cheese (or washing it down with a glass of wine). Because the U.S. government is not in the business of dictating what individual citizens can and cannot eat—and because the "risk society" expects government to protect citizen well-being (Beck 1992)—dietary suggestions are accompanied by manufacturing restrictions. The aging requirement for raw-milk cheese represents a case of regulating from the exception—the exceptional consumer, pregnant or immunocompromised, but also the exceptional producer (a bathtub is not standard cheese-making equipment). Pasteurianism is a biopolitics predicated on the indirect control of human bodies through direct control over microbial bodies. It contributes to the production of rational risk-minimizing subjects and to a governmentality devoted to managing public risk. As John Sheehan, director of the FDA's Division of Dairy and Egg Safety, warns in the agency's consumer magazine, "Drinking raw (untreated) milk or eating raw milk products is 'like playing Russian roulette with your health'" (Bren 2004). The implication is that properly civic-minded Americans would do no such thing.

As Foucault might have predicted and as this article has discussed, there is resistance to such Pasteurian power. Other examples of what I call post-Pasteurian microbiopolitics—alternative ways of thinking about what Pasteurians would simply dismiss as irrational risk behavior vis-à-vis microbes—might include Erin Koch's (2006) study of Georgian inmates bartering tubercular sputum as a ticket to more hospitable facilities, the price of which, they realize, may be contracting tuberculosis. In the United States, mandatory vaccination programs have led not only to the near-eradication of polio and smallpox but also to antivaccination campaigns, including recent resistance by parents in the United Kingdom and the United States who fear that thimerosal, a mercury-based preservative used in vaccines, might cause autism—or even, drawing a parallel with antibiotics resistance, that "overvaccination" might undermine a child's natural immune system.[13] Less dramatically, when it comes to food, the Italian-based Slow Food movement argues

in its manifesto, "International Movement in Defense of the Right to Pleasure," that gastronomic pleasure need not pose a heath risk (Petrini 2001). Rather than embrace risk as "sexy" (as some resist biopolitical "safe-sex" campaigns), post-Pasteurians reject the modern risk discourse diagnosed by Ulrich Beck (1992) and promulgated by the FDA as the most relevant framing of certain food choices (see Enticott 2003b). For them, eating raw-milk cheese is not like eating fugu fish (or having unsafe sex, or playing Russian roulette); it should—and can—be perfectly safe, even healthy.

In *Wild Fermentation,* Sandor Ellix Katz precisely articulates what I have called a post-Pasteurian attitude: "Microbial cultures are essential to life's processes, such as digestion and immunity. We humans are in a symbiotic relationship with these single-cell life-forms. Microflora, as they are often called, digest food into nutrients our bodies can absorb, protect us from potentially dangerous organisms, and teach our immune systems how to function. . . . Microorganisms are our ancestors and our allies" (2003:2). Katz, who lives in a queer intentional community in rural Tennessee, adds a diet of probiotic, fermented foods (including his own raw-milk cheese) to a pharmacological strategy of living with HIV. In this, as in the founding of the Cheese of Choice Coalition, we might see what Rabinow (1996) has termed *biosociality,* a self-fashioning organized around a collective sense of biologized identity. Just as people in, say, patient advocacy groups use scientific knowledge to reconfigure communities, the Cheese of Choice Coalition lobbies the FDA about the health benefits of raw milk and the hygienic promise of HACCP. Like pregnant women consulting online bulletin boards in deciding about prenatal testing—and what to eat for lunch—cheese makers trading tips on working with raw milk construct counterknowledges about biological processes and selves. Gareth Enticott (2003b) describes a community in rural Devon where villagers look to unpasteurized milk to distinguish rural folk from urban transplants, between those whose bodies are "used to the bugs" in a local dairyman's raw milk and those who have a stomach only for supermarket stuff. So strong is the microbiosociality of the local "milk-round" that one newcomer confessed to Enticott that she continued to buy raw milk to signal community-mindedness even after she stopped feeding it to her children, who "tended to have tummy bugs quite a lot" (2003b:420). Here, microbes are seen to connect cows and humans within a milieu, creating locality. As Enticott notes, the "lay immunologies" of villagers do not "discriminate between good or bad bacteria" (2003a:265). Rather, for them the "naturalness" of raw milk largely accounts for its healthfulness.

The Cheese of Choice Coalition, in contrast, calls on microbiologists to provide scientific validity for their cause. University of Vermont dairy scientist Paul Kindstedt (2007) cautioned in his keynote address to the American Cheese Society that post-Pasteurians must sort through "good" and "bad" science to shore up their claims legitimately. Sorting out helpful and harmful microbes is at once a cultural, scientific, and moral enterprise.

LIVING WITH LIVING CHEESE

Cheeses, particularly raw-milk, natural-rind varieties such as Vermont Shepherd, derive complex flavors and satisfying structure from the action of bacteria, yeast, and mold on the proteins in milk. Cheese aficionados characterize the difference between a raw-milk cheese and a pasteurized one in terms of liveliness: a raw-milk cheese, whose composition and flavor continue to develop until it is consumed, is said to be "alive," whereas a pasteurized, shrink-wrapped cheese is "dead." Microbial life, then, not only contributes a kind of labor to the production of cheese and other fermented foods but also confers vitality on them. Thus raw-milk cheese is spoken of as an organism that "matures," "hits puberty" (as David Major has it), and "ages." Wheels of Vermont Shepherd have biographies. If you purchase a wheel directly from the farm, your FedEx package will include a card detailing the weather and any special farm conditions the day the cheese was "born." In another biological idiom, raw-milk cheese is also described as an *ecosystem* or microcosmic farm, with microbial flora and fauna to be carefully tended, cultivated, and cultured. To offer one illustration, in a workshop for fledgling cheese makers Peter Dixon explained the craft of curing washed-rind cheeses by drawing agricultural analogies: "We want to cultivate the right soil, if you will, for the right things to grow." Either view unnerves FDA personnel, who see in cheese a potential biohazard that pasteurization and industrial processing can tame or denature into a safe food product.

In his discussion of biosociality—in which he speculates more about tailor-made genetically modified foods than a biologically inspired resistance to such items—Paul Rabinow evokes Rimbaud's peculiar claim that "the man of the future will be filled with animals." Pointing to genes shared between mice and men, Rabinow (1996:105–107) takes a genetically reductionist view on what this might mean. From a more embodied perspective on the human, to me Rimbaud recalls my own post-Pasteurian squirm of something between disgust and awe in reading that 90 percent of cells in a human body are microbial. A 2006 *Science* article reports that the collective genome of microorganisms residing in a healthy human

gut contains 100 times as many genes as the human genome (Gill et al. 2006). An anthropology of microbiopolitics could, in this light, contribute to a "full picture of the human organism [seeing] it as a 'composite of many species and our genetic landscapes as an amalgam of genes embedded in our *Homo sapiens* genome and in the genomes of our affiliated microbial partners'" (Bäckhed et al. 2005:1915, quoted in O'Malley and Dupré 2007:157–158)—what has come to be called our "microbiome" (Hooper and Gordon 2001:115). Microbiologists are coming to see humans as "superorganisms whose metabolism represents an amalgamation of microbial and human attributes" (Gill et al. 2006:1355). Marcellino says something similar about the hybrid nature of cheese.

Once cheese is recognized and valued as a living organism or microcosmic farm—once it becomes a microbiopolitical object—care of the cheese, care of the animals, care of the land, and care of the consuming self all must consider the microbe. If, in Rabinow's phrasing, "in biosociality nature will be modeled on culture understood as practice" (1996:99), in microbiosociality, the culture understood as practice includes microbial cultures. Practices of nature–culture are microbial as well as human. This is well known to cheese makers working with raw milk, like David Major and Mateo Kehler, who use bacterial inoculation, salt, and environmental humidity and temperature to work with—not against—the biochemical nature of milk to facilitate the victory of "good" bugs over "bad." Microbial culture in cheese making, like human culture in anthropology, is not a thing, not a context, but as Michael Herzfeld (1997:3) and others have suggested, culture is a process, a relation: a verb (see also Fischer 2007:39). The culturing of cheese not only entails directing milk toward a value-added commodity but means considering how we want to live in a world where microorganisms are inescapably, although not always visibly, part of the political, social, experiential landscape.

Over the last 30 years anthropologists have added to our notion of culture practice, politics, and ethics; so, too, do cheese makers incorporate these into their understanding of cheese culture. As working with David Major taught me, the culturing of cheese happens through webs of human and microbial practice suspended in market, governmental, and microbiopolitical fields of power. Entering such fields successfully requires expert knowledge. Cornell-trained dairy scientist Paul Kindstedt, who now advises artisans about the science, safety, and regulatory requirements of cheese making, writes, "The challenge for the farmstead cheesemaker is to strike the right balance between art and science. The goal should be to achieve the appropriate level of control to ensure safety and consistently high quality while at the same time giving nature enough free rein to

encourage the diversity and uniqueness of character that make artisanal cheeses special" (2005:37–38).

In keeping with a biotechnological sensibility, advocates and practitioners suggest that care of these microbes may pay unexpected dividends for humans. Mateo Kehler looks to raw-milk cheese—produced safely only at an artisan scale—to provide a future for family farmers and to preserve Vermont's "working landscape" because it requires clean milk from animals on pasture and fresh-dried hay, not commodity corn. This is sustainable biotechnology in service of an alternative agriculture critical of globalization and agribusiness—even, perhaps, a kind of biopolitics that asks for pastoral practices extending beyond the care of the (human) self. Similar to the implications of Enticott's and Marcellino's research, Kehler's vision offers an expression of localism, a people's connection to the land, to a place, to a shared way of life. Raw-milk cheese is readily enlisted into alternative agrofood politics.

Taking this politics a step further, Sandor Katz, in complaining about the standardization enforced through global commodity trade, sliding smoothly between human and microbial cultures, argues, "One small but tangible way to resist the homogenization of culture is to involve yourself in the harnessing and gentle manipulation of wild microbial cultures. . . . Build your body's cultural ecology as you engage and honor the life forces all around you" (2003:27). Picking up on perhaps a different life force, the Cheese Nun scales up to the level of Creation, valuing the biodiversity of cheese mold because, when she looks through her microscope, she sees "something microcosmic that opens up a world to me, a vision," an experience she likens to that of Saint Benedict, who "saw the whole world in a ray of light" (Thompson 2006). Microbes' reputation is being dusted off. Renewed appreciation for what Conn described in an 1892 talk, "Some Uses of Bacteria," may help to explain the intense anxiety and self-doubt that run alongside the anticipatory maternal virtue expressed by pregnant women concerned with what they eat. The ethical subjectivity they adopt is consistent with biomedicine (what in other work I call an ethic of well-being [Paxson 2004]) and firmly anchored in Pasteurian thinking—the limits of which consumers are increasingly aware.

Aimed at a variety of moral ends, a post-Pasteurian care of the self goes through the obligatory passage point of caring for the microbe—the good microbe, the *Lactobacilus* or *Penicillium* companion species whose bodies and cultures are coproduced with human ones. In so doing, post-Pasteurians make explicit that human and microbial nature–culture is the ongoing outcome, not raw material, of history. For some, this suggests new opportunities to cultivate—with practical

care, scientific literacy, and political consciousness—an artisan agriculture that might remain biologically, environmentally, civically, and financially viable.

ABSTRACT

Out of concern for public health, the U.S. government bans the sale of cheese made from unpasteurized milk if it is aged fewer than 60 days. But while the FDA views raw-milk cheese as a potential biohazard, riddled with pathogenic microbes, aficionados see it as the reverse: as a traditional food processed for safety by the action of good microbes. This article offers a theoretical frame for understanding the recent rise in American artisan raw-milk cheese production, as well as wider debates over food localism, nutrition, and safety. Drawing on ethnographic interviews with cheese makers and purveyors and on participant-labor conducted on a Vermont sheep dairy farm, I develop the concept of microbiopolitics to analyze how farmer–cheese makers, industry consultants, retailers, and consumers negotiate Pasteurian (hygienic) and post-Pasteurian (probiotic) attitudes about the microbial agents at the heart of raw-milk cheese and controversies about this nature–culture hybrid.

Keywords: biopolitics, food politics and safety, alternative agriculture, microbes, raw-milk cheese

NOTES

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1. Eighty percent of Vermont farmstead cheese is made from raw milk (Sakovitz-Dale 2006:4). Sixty-five percent of New England cheese makers, and 50 percent nationally, work with raw milk (Roberts 2007).
2. Vermont Dairy Promotion Council, http://www.vermontdairy.com/dairy_industry/farms/numbers, accessed July 7, 2007.
3. Compare Helmreich 2003 on the microbial undoing of genealogy and on modes of biopolitics organized not through "sex" but through practices of organic and biotechnological "gene transfer."
4. Insofar as it describes a mode of social management that admits of the agency of microbes, for bad and good, what I am calling microbiopolitics is distinguishable from the "molecular biopolitics" analyzed by Nikolas Rose (2006) in discussions of pharmacogenomics and from what Troy Duster (2006) terms the "molecular reinscription" of race. My coinage also differs from the "microbiopolitics" developed by geographer Nigel Thrift to describe the affective force of media technologies, which, he writes, "require a microbiopolitics of the subliminal, much of which operates in the half-second delay between action and cognition, a microbiopolitics which understands the kind of biological-cum-cultural gymnastics that takes

place in this realm" (2004:70–71). This to me recalls Bourdieu's notion of "habitus" rather than Latour's microbial agents, my inspiration for prefixing Foucault's biopolitics.

5. EZAL 4001 and 4002 are farmhouse acidifying mesophilic cultures containing *Lactococcus lactis, Lactoccocus cremoris, Lactococcus lactis diacetylactis*, and *Streptococcus thermophilus*.
6. See http://www.slowfoodusa.org/ark/farmstead_cheese.html, accessed June 28, 2007.
7. See Bromberger 2005 and Rogers 2006 for anthropological treatments of Protected Designation of Origin cheese "traditions" in Britain and France, respectively.
8. See http://www.cfsan.fda.gov/d̃ms/listeren.html, accessed July 7, 2006.
9. See http://www.babycenter.com/comments/pregnancy/pregnancynutrition/3175, accessed July 12, 2006, and July 6, 2007.
10. See http://www.cfsan.fda.gov/p̃regnant/whillist.html, accessed July 7, 2006.
11. See http://www.bt.cdc.gov/agent/agentlist.asp, accessed July 17, 2006.
12. The most common problem with silage is *Clostridium,* a CO_2-producing anaerobic bacteria that will explode and produce gas bubbles, generating "puffy cheese" and a bad taste. It is not, however, harmful to consumers.
13. See a 2003 *Wall Street Journal* editorial dismissing concerns over thimerosal (http://www.opinionjournal.com/editorial/feature.html?id=110004487) and the outraged response it provoked (http://www.opinionjournal.com/editorial/feature.html?id=110004700, accessed July 16, 2006).

Editor's Note. Cultural Anthropology has published several essays on food and the politics of food. See, for example, Benjamin Orlove's (1997) article on food riots in Santiago, Chile, Mark Liechty's (2005) "Carnal Economies" interconnecting food and sex/gender, or Judith Farquhar's "Eating Chinese Medicine" (1994) on the intersection of food and health. Scientific culture and science in action have also been important sites of inquiry in *Cultural Anthropology*. Of particular relevance are Karen-Sue Taussig's "Bovine Abominations" (2004) and Sarah Pinto's (2004) article on the interconnection of "self-made" doctors and institutional medical and scientific practice.

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