**Debating Milk: Milk as Nutritious and Safe**

by

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**Abstract**

Since the early decades of the 20th century, the alignment of germ theory, pasteurisation technologies, nutrition, administrative and regulatory systems, and illness has normalised unpasteurised milk as dangerous while positioning pasteurised milk as safer and equally nutritious. This alignment constitutes a metanarrative that is used to organise public interactions with milk and has become part of a common heritage in Canada and the United States. My dissertation is about problematizing this metanarrative in an effort to understand the role science plays and has played in constituting pasteurised milk as a safe and nutritious food. The metanarrative that has formed around milk is interesting because it attempts to exclude and delegitimise the experience of drinking unpasteurised milk safely. This gap between the metanarrative and the experience of drinking raw milk safely has opened up a discursive space where raw milk activists can confront the metanarrative and reimagine milk as a more wholesome, nutrient-dense food that does not need to be pasteurised.

This is fascinating because scientific discourses about milk present it as a dangerous food that requires pasteurisation; yet, different laws and government policies regarding milk have developed differently across diverse political landscapes. Unpasteurised milk is sold legally in Britain (except Scotland) and in many of the states within the United States. In Canada, it is illegal to distribute unpasteurised milk throughout the country. The implication of such diverse policies is that pasteurizing milk may not be necessary under all circumstances. My goal is to problematize how science only values milk in accordance with a particular set of scientific rationalities—especially those built around germ theory—that configure pasteurised milk as nutritious and safe while ignoring alternative views about the benefits of drinking raw milk safely. My focus is on how the metanarrative was and is being constituted by the scientific discourses of nutrition and safety. Therefore, I examine how these discourses emerged

discursively within social contexts. I also examine how those ideas and claims act as the current institutional lens used to discipline challengers to the metanarrative. In that effort, I use genealogy and discourse analysis as my analytical methods to disturb the assumptions and claims of the metanarrative.

Since this is a paper-based dissertation, each paper is a self-contained discussion of some different aspect of the past and/or present controversies around the value of pasteurising milk. Each paper points to an issue that represents the importance scientific ideas have in coordinating the various experiences of drinking milk. For that reason, I chose three specific and very different sets of problems that have arisen in attempts to comprehend milk. Then, in each paper I problematize some aspect of how past and present beliefs about milk were or continue to be constituted in ways that reveal the unstable and contestable nature of scientific theorising and the efficaciousness of the technological interventions.

I find that institutionalised medicine continually moves toward creating static and simplified explanations around milk that authorise a particular view of milk that is easily administered and aligned with cultural-economic conditions. This dissertation argues that it is unreasonable to continue framing unpasteurised milk through a simple binary of dangerous versus safe or to continue valuing milk in terms of a reductionist nutritional paradigm. In Canada and the United States, the metanarrative is being challenged by raw milk activists as an arcane and static narrative that is institutionally "locked-in" and rigid. They claim that this metanarrative now mostly serves corporate distributors of pasteurised milk and protects pasteurised milk as a particular kind of commodity that has a longer shelf life and can be traded over long distances. Scientific ideas and claims contribute to these circumstances and I examine how they operate as a disciplinary technology. Challengers to the metanarrative do not appear to

be calling for the withdrawal of scientific intervention, but rather for a reimagining of (1) how science conceptualises milk as healthy or dangerous and (2) whether those reimagined representations of the relationship between germs, pasteurisation, bodies, and illness could be used to leverage changes in the economic structures of accumulation and the political policies that support them.

**Preface**

This paper-based dissertation is an original work by Stephen Speake. All the research in this dissertation was completed for this project. However, in 2011, the second paper was published in the peer-reviewed journal: *Studies in History and Philosophy of Biological and Biomedical Sciences, 42*(4), 530-541. The paper is titled, "Infectious milk: Issues of pathogenic certainty within ideational regimes and their biopolitical implications" (doi:10.1016/j.shpsc.2011.06.002).

For Mum

No other person has believed in me or supported me as much.

No words can express my love or appreciation.

Thank you.

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# Introduction: Part I

## Study Context

> Everything we eat is tinkered with in one way or another. With every tinkering come losses, some small and unavoidable, some large and avoidable; the cumulative amount of these losses is staggering and crippling. (Davis, 1970).

The different ways in which unpasteurised milk is regulated in Britain, Canada, and the United States motivated me to look at how the state generates stable representations of milk as nutritious and safe. In all three countries, milk is a highly regulated food *cum* commodity subject to the health and safety claims of various experts. In all three countries there is a similar metanarrative that orients the state's attitudes and beliefs about how the public should interact with milk. The concept of a metanarrative was put forward by French philosopher Jean-François Lyotard. Metanarratives, he claimed, are totalising explanations that attempt to explain events, experiences, and socio-cultural phenomena by appealing to transhistorical and universally generalizable theories and practices. These types of explanations presume some epistemological and ontological access to reality that others neither have nor can legitimately acquire. The effect of a metanarrative is to foreclose on alternative explanations and deny experiences that do not align with the totalising explanation(s) asserted by the metanarrative (Lyotard, 1979, *passim*). Since the early decades of the 20th century, the emergence of an alignment between germ theory, pasteurisation technologies, nutrition, administrative and regulatory systems, and illness has normalised pasteurised milk as equally nutritious and safer than unpasteurised milk while positioning unpasteurised as an inherently dangerous food with no nutritional advantages over pasteurised milk. This alignment constitutes a *metanarrative* that has become part of a common heritage in Canada and the United States and is used to organise public interactions with milk while excluding and delegitimising the experience of drinking unpasteurised milk safely. It is this gap between the metanarrative and the experience of drinking raw milk safely that has

opened up a discursive space where raw milk activists have been confronting the metanarrative and reimagining milk as a more wholesome, nutrient-dense food that does not need to be pasteurised.

There were and are many challenges for the propasteurising researcher-scientist and policymaker attempting to theorise, model, regulate, and administer milk from within and across changing cultural, political, and scientific landscapes. Discourses about diet, nutrition, health, and foodways[1] circulate and inform these processes. The current metanarrative emerged as propasteurisers sought since the acceptance of germ theory during the early decades of the 20th century, however failingly, to establish a unifying explanation threading the multiple ways through which we experience milk as a healthy drink, as a nutritious food, as a vector for disease, and as a commodity into a singular, sacrosanct narrative. In actuality, the metanarrative is a consequence of propasteurisers piecing together workable solutions from within a particular set of historical circumstances; it emerged from instability, and thus may or may not remain a stable or useful framework for conceptualising milk. To demonstrate that instability, I examine some of the scientific rationalities that contributed to the construction of pasteurised milk as a nutritious and safe food and then further query how those configurations continue to organise the public's beliefs and interactions with milk. This type of examination of milk is important because pasteurised milk continues to be widely promoted as a healthy, nutritious food made nutritious and safe through the prescriptions and research of medical science and the application of pasteurisation technologies. However, in making these claims, the current metanarrative also

[1] Foodways refers to "the beliefs and behaviour surrounding the production, distribution, and consumption of food" and reflect the way cultural beliefs about food help to organise the natural world (Counihan, 1999, pp. 6, 19).

operates as a filter that tries to ignore and even suppress alternative views about the benefits of drinking raw milk safely.

"Raw" is a term used by milk activists to refer to milk that is unpasteurised: in fact, they often use the two terms interchangeably. In addition, activists use raw to refer to unpasteurised milk that is locally produced, certified unadulterated, disease-free, and usually organic. Thus, raw milk is milk that comes from healthy cows that are typically, though not necessarily, pasture fed.[2] However, raw and unpasteurised milk are not always equated with each other through the same set of logics. For example, the *Centers for Disease Control* (CDC) (2014) use raw and unpasteurised as synonyms simply because raw milk is already defined as any milk that has not been pasteurised (para 1). Therefore, the safety of milk is determined by whether milk has or has not been pasteurised. This definition does not distinguish between unpasteurised milk produced locally produced and sold directly to customers from a single cowherd and commercial unpasteurised milk coming from multiple cowherds that is pooled, industrially processed, and distributed over long distances by large corporations. This blurring of differences ignores raw milk activists' other concerns about ongoing efforts to meet an array of other hygienic conditions that contribute to raw milk's safety. Differences like these in conceptualising milk as nutritious and safe often show up in the controversies between these two sides.

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[2] Mark AcAfee of *Organic Pastures* in Fresno, California (http://www.organicpastures.com/), for example, qualifies the meaning of raw milk in this way. In presenting raw milk on his website as nutritious and safe, he contextualises raw milk. It is not just unpasteurised milk; it is milk that is produced under particular sets of conditions that make it more nutritious and safer than industrially-produced commercial milk that is unpasteurised (see McAffee, 2013, December 23).

How raw milk gets defined matters because it contributes to how the metanarrative is organised. In Canada, for instance, the federal government bans the distribution and sale of unpasteurised milk throughout the country. In the United States, by contrast, the federal government bans the interstate trade of unpasteurised milk while some states allow its distribution and sale. In Britain, each national government regulates the legal sale of unpasteurised milk, so it is legal in England, Wales, and Northern Ireland but not in Scotland.

Despite these statutory differences, propasteurising state actors continue to circulate the view that milk is dangerous, but nutritious. This view finds expression through state-supported federal institutions, such as Britain's *Food Standards Agency*, the American *Centers for Disease Control* (CDC), and the *Canadian Centre for Infectious Disease Prevention and Control* (CIDPC). At this institutional level, the consensus has only deepened in subsequent decades and has more recently led to the formulation of a set of standardised global practices and regulations that all nations are meant to meet (Codex Alimentarius Commission, 2000). Select scientific studies have been used to contribute to the stability of that consensus, resulting in the enactment of laws that reflect those scientific views. In fact, the public's image of milk as a "pure" food has remained remarkably stable over the course of the last century even though scientific ideas and practices surrounding milk have changed dramatically (Smith-Howard, 2014). Over that time, the public's understanding of milk has been reconfigured and aligned with these science-based legislative trends that continue to reproduce and stabilise the metanarrative. Unfortunately, the metanarrative oversimplifies human interactions with milk. Despite this science-based, legislative trend, politicians have also had to respond to raw milk activists and other members of the public who are resisting any simplistic attempts to describe and regulate milk.

What motivates this study, however, is not how different laws and government policies have developed within different political landscapes, but rather how scientific discourses about nutrition and danger were and are being organised, shaping divergent practices around milk through a common metanarrative. I am interested in how science normalises foods as healthy, nutritious, and safe. The promotion of highly processed, denatured foods by state actors as healthy and nutritious is configured by an appeal to knowledge regimes that produce foods according to a particular "truth". This prompted me to consider a rather simple question about how scientific claims and practices have and continue to inform different social contexts differently. Are the claims scientists produce around the nutritional value and safety of milk just being politicised by economic-social-political forces or is scientific activity and the knowledge claims it produces already politicised? It is an examination of the second question that orients the research in this project. Through that question, I began to investigate the discursive conditions through which knowledge about milk was produced and continues to be reproduced within the particular socio-scientific contexts of North America and Britain throughout the 19$^{th}$ century and the early decades of the 20$^{th}$ century.

The metanarrative persists even though the sale of unpasteurised milk is already legal in some local jurisdictions. The implication is that the compulsory pasteurisation of milk under all circumstances may not be necessary other than as a way to protect the current medical, political and economic status quo that preserves the profitable distribution of milk on a national and global scale. A brief look at what is being done differently in each of these countries seems a valuable way to emphasise the social tensions created by the metanarrative in Canada, Britain, and the United States.

**Unpasteurised milk in Canada, Britain and the United States**

Over the decades there have been various attempts to standardise pasteurisation criteria (Holsinger, 1997). The Alkaline Phosphatase Test is currently the standard used to determine whether milk has been sufficiently pasteurised to make it safe for consumption (Rankin, 2010). Phosphatase is an enzyme in milk that "is slightly more heat resistant than most pathogenic material"; therefore, its inactivation through heating confirms an adequate level of pasteurisation (Fadiloğlu, Erkmen and Sekroglğu, 2004, p. 27). The search for more efficient methods to eliminate pathogens in milk is ongoing. Research done by Condron *et al* (2015) for organisations like the *International Dairy Federation* (IDF) attempts to promote international protocols and standards for evaluating milk safety. The goal of this type of research is to determine the thresholds needed to eliminate and/or reduce pathogenic content in milk (Holsinger, 1997). Creating more efficient pasteurisation techniques and technologies cannot be applied to the production and distribution of raw milk, however. Therefore, how unpasteurised milk can be made safe continues to be a hotly contested issue (Oliver et al, 2009). Safety can no longer be just about intervening at the site of milk. The problem, as Oliver et al (2009) points out, is not only how to manage the numbers of pathogens found in unpasteurised milk without pasteurising the milk but how to keep unpasteurised milk pathogen-free so that there is some level of assurance that the milk is safe to drink. Typically, these issues have been dealt with by labelling raw milk a potential health risk and raising the hygienic standards of the farms where raw milk is produced. Yet, there is then the perpetual problem of policing numerous individual sites of raw milk production. For the propasteuriser, this is completely unnecessary since science has determined that milk is an intrinsically risky food (Straughan, 1995). Moreover, LeJeune and Rajala-Schultz (2009)—representatives of the dominant metanarrative—argue that since pasteurisation does not change the nutritional content of milk, it is unnecessary to make raw milk

available to the public. They believe that once the science is properly understood, controversies around pasteurisation will subside.

The dominance of the metanarrative has consequences for the public. On 20 October 2008, the provincial government of Ontario charged Michael Schmidt of Glencolton Farms with 19 counts of violating the province's *Health Protection and Promotion Act* and *Milk Act*. Both Acts make it illegal to sell unpasteurised milk directly from the producer to the Canadian public and are a reflection Canada's federal law. Canada's *Food and Drugs Act* (rev. 1985) and the *Food and Drug Regulations* of 1991, section B.08.002.02[3] is the basis for all provincial law and imposes a nationwide ban on the sale of unpasteurised milk to the public for reasons of maintaining public health and safety. Not surprisingly then, Ontario's Premier Dalton McGuinty refuses to entertain any changes to Ontario's pasteurisation laws believing science is providing best advice for protecting the public (Oliveira, 2007, November 22). The Federal government has the same view and takes the threat of potential health risks from consuming unpasteurised milk very seriously. In fact, Canada remains the only G7 country that does not allow the sale of unpasteurised milk to the public (CBC News, 2009). Canadian law allows courts to impose fines up to $250,000 or sentence offenders up to three years in jail for anyone selling unpasteurised milk to members of the public for their personal consumption (Tryon, 2002, December 18).

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[3] The law reads: no person shall sell the normal lacteal secretion obtained from the mammary gland of the cow, genus *Bos*, or of any other animal, or sell a dairy product made with any such secretion, unless the secretion or dairy product has been pasteurized by being held at a temperature and for a period that ensure the reduction of the alkaline phosphatase activity so as to meet the tolerances specified in official method MFO-3, Determination of Phosphatase Activity in Dairy Products, dated November 30, 1981.

Despite these harsh penalties, no person has ever reported becoming sick in over 25 years of Schmidt "selling" unpasteurised milk (Johnson, 2008; Selick, 2009). Yet since 1994, Schmidt has been engaged in a series of legal battles defending his right to distribute unpasteurised milk to people who choose to drink it.

In his latest encounter with Ontario law, the courts handed down a surprising decision on January 21, 2010 that found Schmidt was not guilty of all nineteen of the charges laid against him (Canadian Press, 2010). While representing a personal victory for Schmidt, the judge's verdict arises from a loophole in the current legislation about how many people can own a cow and was not a decision about whether pasteurisation is a necessary public health measure. Schmidt has been running a "cow-share" operation that allows members of the public to partially own a dairy cow and in return for paying for the animal's upkeep these partial owners receive a portion of the cow's milk, which happens not to be pasteurised. Current laws do not ban the corporate ownership of dairy animals. Schmidt returned to court 5 February 2014 to further litigate this issue. Ontario's Court of Appeal has not made a decision at the time of this writing, but no doubt this decision will give rise to future cases about the legality of cow-share operations in Ontario and the rest of Canada.

In Britain, successive governments have generally been reluctant to legislate an outright ban on the sale of unpasteurised milk to the public, even though the Ministry of Health's *Food Standards Agency* continues to seek the universal, compulsory pasteurisation of milk on the grounds that it is the safest alternative (P. Hagan, 2006). In response to these kinds of pressures, the British Parliament attempted to ban the sale of all unpasteurised milk to the public in 1983, but public outcry soon overturned that policy decision. While Scotland has maintained that ban, England, Wales, and Northern Ireland reintroduced the sale of unpasteurised milk in 1985 with

much stricter hygiene and labelling regulations warning the public of the potential health risks from consuming unpasteurised milk.

The English and Welsh governments returned to the issue once again in 1997 in response to another government agency report restating the risks to public health. Many in the public remained unconvinced and again successfully blocked government attempts to end public access to unpasteurised milk. Two years later, in 1999, the English and Welsh governments jointly announced they would no longer seek to ban the sale of unpasteurised milk. Even still, some Welsh government agencies have again been campaigning to ban the sale of unpasteurised milk since 2002. Yet throughout the controversy, the demand for unpasteurised milk in England and Wales is increasing (P. Hagan, 2006). All three countries regulate the sale of unpasteurised milk through the *Food Hygiene Regulations* that were last renewed and updated in 2006. For the time being, the British government continues to allow the sale of 'green top milk' (certified raw milk)—"green top" because the milk bottle caps are coloured green—that meet even higher standards of hygiene than the earlier 1985 legislation.

In the United States, the *Food and Drug Administration* and the CDC continue to discourage people from drinking raw milk (Byrne, 2011). The FDA began regulating the pasteurisation of milk in 1969 (Hawthorne, 2005, p. 45). Since then the federal government, on the advice of many of its agencies, including the FDA and the CDC, continue to impose a universal ban on the sale of unpasteurised milk to the public across state lines and encourages state regulators to do the same. Initially the FDA's regulations were vague admonishments restricting the transport of adulterated and deceptively mislabelled products across state lines. Additionally, foods could not be missing core ingredients or be "filthy, decomposed or putrid" and included milk (p. 41). However, one of the early problems the FDA had in regulating food

and drugs after its inception in 1906 was the lack of enforcement tools other than the courts—this was a burdensome and time consuming process that could not put an immediate stop to the production and distribution of dangerous foods (p. 41). Certainly, prior to 1940, many courts were reluctant to prosecute cases where dairy producers failed to pasteurize their milk (Wright & Huck, 2002). Nevertheless, it would be 1962 before the US Congress insisted the FDA begin regulating foods using science-based empirical studies. In 1970 (revised in 1985) the FDA would mandate that empirical studies must include more rigorous studies using double-blind, randomised studies.

As Hawthorne (2005) describes it, this demand for scientific rigour was soon undermined by corporate-political intervention. The producers of the cancer-causing sweetener saccharin received a Congressional exemption in 1977, This was followed by a wave of deregulation with the election of Ronald Regan in 1980 and the election of a Republican majority in Congress in 1994. This political environment pushed the FDA into a decade of regulatory missteps leading to suspect approvals, budget cuts, bureaucratic sprawl, unclear jurisdiction boundaries, the direct corporate lobbying of politicians by corporations to subvert the FDA approval process, controversial and inadequate leadership at the FDA. This situation was made worse by its slow response to the emerging AIDS crisis beginning in 1981, which undermined its public image as a protector of public interests. Finally, its role in protecting capital investment and the need to commercialize and profit from a trade in commodities, the approval of growth hormones in dairy animals, and the decline in monitoring sanitary practices have also contributed to declines in public confidence (pp. 42-46). The dairy industry has consistently given between two and four million dollars to the Republicans and Democrats from 1998 to 2008. In 2008, the Dairy industry spent $4.15 million, with 61 percent of that total going to the Republicans; no money came from

organic dairy farmers. Typically, the money comes from dairy farmer cooperatives interested maintaining fair and stable prices and incomes for commercial dairy producers (Center for Responsive Politics, 2008). This means there are strong systemic arrangements influenced by large, corporate interests affecting what types of milk get produced and how milk is regulated.

One of the most visible of raw milk activists, Mark McAffee of Organic Pastures Farm near Fresno, California, for instance, has produced and sold organic unpasteurised milk from grass-fed cows since 2000 and is often confronted by state regulators looking for any infringement to shut him down. He sees state regulators as working against the legal producers of unpasteurised milk in the service of large corporate dairies (McAffee, 2004, 2007). The California *Department of Food and Agriculture* (CFDA)—the department charged with enforcing the legal sale of unpasteurised milk under the *Milk and Milk Products Act* of 1947—actively works with dairy industry lobbyists and public health officials to stop the distribution of unpasteurised milk on the grounds that it poses a threat to public health and safety. It seems that instead overturning the 1947 Act and appearing to take away the right of people to choose, state agencies have been successfully challenging and changing the standards for testing milk safety. State regulations in California make it very difficult for the state's producers of unpasteurised milk to meet those standards (CFDA, 2008). That struggle is on-going.

Nevertheless, it is now possible to obtain raw milk in 39 states; however, only 10 of those states allow for retail sales, whereas in the other 29 states consumers must purchase raw milk directly from the producer (WAPF, 2014d). A recent CDC survey estimates about 9 million Americans drink raw milk regularly (Hartke, 2012). In Canada the number of raw milk drinkers is an estimated 1 per cent, or roughly 250,000, of the Canadian population (Naturalmilk.org, 2005). While the overall volume of unpasteurised milk sales in all three countries continues to be

small, and difficult to measure, the demand for unpasteurised milk is a growing phenomenon in both Britain and North America (Barry, 2009; Drape, 2007, August 8; Labes, 2008, January 18; Madden, 2008, February 23; Tryon, 2002, December 18). The numbers are similar in England. The sale of green top milk accounts for about 1 per cent of all milk sales, and now comes with a warning label about the potential dangers of drinking unpasteurised milk. It is purchased almost entirely from the approximately 130 government approved dairies (P. Hagan, 2006). Despite the efforts of all three national governments seeking to deny access to raw milk, some members of the public continue to push governments to recognise the benefits of drinking raw milk. Whether milk is sold through illegal underground networks, as is the case in Canada and some parts of the United States, or sold legally, as it is in Britain (except Scotland) and some American states, it is a persistent social phenomenon despite attempts by these national governments to impose universal, compulsory pasteurisation laws.

In reality, the consumption of unpasteurised milk has continued to some degree in all three countries. In Britain, where legislation banning trade in unpasteurised milk was the weakest among the three, unpasteurised milk consumption actually peaked in the 1950s long after the initial crisis that triggered the movement toward compulsory pasteurization began in the last decade of the 19th century (Burnett, 1979). Colin Spencer in his book *British Food* writes unpasteurised milk consumption declined in Britain after the 1950s and not because the public believed unpasteurised milk was dangerous but because unpasteurised milk has high levels of saturated fats, which had then become the major health concern (Spencer, 2002, p. 298). In the United States, the very popular 1950s nutritionist and biochemist Adel Davis (1970) in her book *Let's Eat Right to Keep Fit* continued to advocate the consumption of unpasteurised milk coming from healthy animals grazed on fresh green pastures. Milk taken from these animals does not

require pasteurization, she wrote, and milk that needed to be pasteurized could be "pasteurised" naturally by souring the milk or making yogurt, making the loss of "nutrients" such as hormones, enzymes and steroids avoidable (pp. 103, 228). Only in Canada has the government moved towards a complete ban on the sale of unpasteurised milk to the public.

These federal policies are clearly meant to protect the public from the dangers of raw milk. However, food scares involving the consumption of raw milk have been infrequent and usually involve small numbers of people (Byrne, 2011; Hartke, 2012; Headrick et al, 1998; Langer et al, 2012). Hartke (2012), a raw milk activist, argues that these threats are overstated in an effort to preserve the status quo around milk production. Similarly, Byrne (2011) also suggests there is a relationship between the acceptance of pasteurisation and the transition to economies of scale over the last century. Nevertheless, these outbreaks are happening within the broader context of other food scares.

The public's understanding of what constitutes safe foods is being fundamentally challenged by the reoccurrence of food scares and the use of scientific explanations to explain them (Lupton, 1996). Politicians, industry, and science are organising a globalised and standardised form of industrial production (Ilcan and Phillips, 2003). There is an attempt to appropriate and reconfigure nature through these processes in order to facilitate global trade. Efforts to standardize foods, according to Schaeffer (1993, found in Murdoch and Miele 1999), are in part undertaken not only to raise quality standards but also to act as a point of reference for producers and consumers separated by great distances. Notions of quality are tied to standardized features that are increasingly shared across a range of products and are promoted by large agro-businesses and retailers to facilitate sales. Standardization, then, has since become associated with "unnatural" foods; this is in part because standardized foods are not associated with or

traceable to any particular site of production (p. 469). Foods produced outside this system take on a different meaning. Nygard and Storstad (1998) find locally produced foods are generally associated with higher quality foods, that is, safer foods. Foods produced locally are seen as clean and green and therefore more desirable because of their proximity to nature. There has been a bifurcation between standardized, industrialized global food networks and local, specialized food production. Notions of quality under that model have become a narrow set of criteria focused on efficiency of production and cost issues. The pursuit of affordable, mass-produced foods has side-lined "natural" production that might otherwise provide different ideas about the standards of production (Nygard & Storstad in Murdoch and Miele, 1999, p. 470). Changing perceptions about what is natural and safe are changing public behaviours.

The American organic market is certainly expanding and growing at an estimated 12 per cent annually (Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007). This retreat to natural, organic, and local foods has result in what Murdoch, Marsden, and Banks (2000) have called the "quality turn". Yet, this turn is accompanied by consumers uncritically accepting that organic and local foods are safer, thus they are still avoiding critical engagement with the complex ideas surrounding food safety and holding to the view that local foods are more authentic foods (i.e., closer to nature) and therefore safer (Enticott, 2003). Quality is often equated with safety in the retail sector as the guidelines and consumer demands for safe products determine what gets sold in retail (p. 119). The equivocation of quality with safety may or may not have any linkages with the nutritional quality of foods like milk and/or reflect any linkages between consumption and the production of general health. The media also plays a significant role in reproducing public fears about these complex issues by reducing media representations to organic versus conventional foods (Lockie 2005).

Increasingly, the public is growing dissatisfied with industrial models of food production (Gliessman, 2012; Kremen and Bacon, 2012). Davidson, Jones, and Parkins (2015) argue that transitions within the standardized global food system to more "natural" foods are facilitated by some disruptive event, such as BSE, that raises the spectre of fear in the public from food-borne illnesses. These types of events make a space for niche producers to move into the market and provide organic and "natural" foods that are outside the conventional industrial agro model. They conclude that the emergence of these niche markets is being driven by consumer concern about food safety and also the corporate disenfranchisement of beef producers. Other research also suggests that consumers are subsequently moving to natural, organic, and locally produced foods to minimise their exposure to the risks associated with industrial production (Kouba, 2003; Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007; Murdoch et al., 2000; Murdoch & Miele, 1999). Murdock, Marsden, and Banks (2000) discuss how consumer notions about the "quality" of foods are now being mediated by ideas about food embedded in local ecologies. This is a response to efforts made by industrial producers to "reduce the importance of nature in the food production process" (p. 109). Goodman et al (1987) write that the processes of *appropriation* (replacing natural production with industrial practices) and *substitution* (substituting natural products with artificial products) has made the public suspicious as industry tries to "outflank" nature by increasingly removing biological constraints to production in an effort to domesticate nature.

Enticott's (2003) study then becomes one of discerning how consumers rationalise consuming organic, local foods even though consuming foods like unpasteurised milk is portrayed as "inherently risky". Enticott sees this largely as a consequence of safety being tied to locality and community membership in rural areas. He finds an contrast between scientific

claims about risk and cultural beliefs about what is risky. This goes to issues about the knowability of nature. This binary of society and nature views nature as a concept-independent and depoliticised space that undermines challenges to authorised claims about it (Goodman, 1999).

Similarly, health promotion theories argue that behaviours around views of health are not always rational and are quite often contrary to those "experts" promoting healthy lifestyles (Fox, 1999). Lupton (1994) also finds that culturally constructed notions of diet often act as a barrier to eating a proper diet as prescribed by health authorities. This may also be true of people who drink raw milk (although, I am not aware of any studies). Evidence suggests that ninety per cent of dairy farmers and their families drink unpasteurised milk (Young et al., 2010). This correlation between dairy producers and their drinking raw milk may reflect a similar cultural pattern and a reason they ignore health authorities. These analyses clearly align with Murdoch, Marsden, and Banks's (2000) idea of a 'quality turn'.

However, what I see in the debates about whether to drink pasteurised milk or not cannot be explained by an unreflexive turn to raw milk. It is not simply about people turning toward natural and organic foods as a refuge from industrial practices. It is also about constructing alternative views about what constitutes nutrition, safety, and health. West (2008) similarly finds that the debates between propasteurisers and activists are complicated and involve serious attempts to challenge science on its own terms. Both experts and non-experts are engaged in configuring risks and hazards in an effort to understand and promote health.

An example of how sophisticated this debate has become can be seen in a discussion about how homogenisation affects the quality of milk and has consequences for health. While I do not devote attention to the issue of homogenisation in the thesis, it does get mentioned in the third

paper because raw milk activists talk about both pasteurisation and homogenisation together when speaking about how milk is changed by industrial processes. Homogenisation of milk prevents the separation of the cream from the whey. To stop that separation, thousands of pounds of pressure forces milk through micro filters and changes the size of the fat globules. This process permanently alters the structure of the fats in the milk (Cano-Ruiz & Richter, 1997). A micro-photographic study shows that there are differences in the sizes of the various fat globules between raw milk and milk that has been pasteurised and homogenised (Rubik, 2012). The Weston A. Price Foundation claims that both processes change the colloidal structure of milk turning it from a living dynamic substance to an inert "dead" substance. Pasteurisation is known to change the "structure of proteins, deactivate enzymes, destroy vitamins and kill microbes" (para, 21). Homogenisation alters the colloidal structures by breaking fat globules down into smaller uniform sizes changing the "living" structure of milk (para, 21). The two processes of pasteurising and homogenising milk are said to impact health and they are not easily separated. It is suggested that homogenised fat particles bypass the normal processes of digestion, enter the bloodstream, and react with the arterial wall perhaps causing long-term health issues (Hartley, 2008, para. 4-8). Other claims have received more attention. Raw milk activists claim common illnesses, such as allergies and asthma, may be attributed to pasteurisation processes. In his summary of some of the ongoing work being done to evaluate health claims about drinking unpasteurised milk, Perkin (2007) points to scientific studies that find drinking raw milk does confer a "protective effect" on eczema, seasonal allergies, and atopy because the milk has not been subject to the processes of either homogenisation or pasteurisation (p. 627). There remain un-researched and under- researched claims used by both sides in this debate. Assessments are confounded by many factors and do not often take into account the conditions under which

unpasteurised milk is distributed and produced. Large vats of commercially unpasteurised milk coming from many different cowherds have different risks/hazards than unpasteurised milk passing directly from the farmer to a consumer.

This back and forth, for my purposes, raises serious questions about how science is producing and privileging certain types of claims over others. Clearly, the 'quality turn' shows there is resistance to state policy and the current metanarrative surrounding milk. Activists are mounting legal challenges that dispute the legitimacy and the reliability of the underlying science. This lack of trust raises questions whose answers take us beyond national issues of legal rights and policy analysis to an examination of the genesis, persistence, and legitimacy of the existing ideational regime, which acts as a springboard for state-corporate-medical action in America, Canada and England. To my knowledge, no advocate for having legal access to unpasteurised milk is advocating the unregulated sale and distribution of unpasteurised milk. The details of these clashes between the propasteurising state and the individual activist/citizen coalesce around how discourses operating through science constitute its explanations and then deploy those explanations to discipline non-compliant activists. This seems to me an issue worth examining.

**The historical importance of milk**

Britain, Canada, and the United States have a common heritage with respect to dairy, which has a long history in English speaking culture going back to at least Roman times (Chapin, 1916; Cool, 2006; A. Hagan, 2006; Wilson, 2003; Woolgar, Serjeantson, & Waldron, 2006). Domesticated in the Middle East some 8,000 years ago, cattle have been used for their labour and their milk ever since (J. McNeill, 2003, p. 30). Clearly, people have not always consumed pasteurized milk, nor have all cultures consumed milk or dairy products. Certainly, the people of the Middle East, the Russian Steppes, the Indian Subcontinent, and Europe have long histories of

interacting with their domesticated cattle herds. Among Northern Europeans, milk and dairy products have been the most abundant and best source of calcium and other nutrients in their diet, since many of the plant foods in these climes were poor sources of energy (Fernandez-Armesto, 2002; Freeman, 2013; Harris, 1985, pp. 139-143). In Britain, the presence of domesticated cattle may have begun as early as 2500 BC. Since then Britons have made simple cheeses by separating the curds from the whey until the discovery of rennet as a way of coagulating, fermenting and ripening cheeses at some later and unknown date. Soured milk (essentially spoiled milk) and simple cheeses would have been widely consumed in their raw state, primarily as butter, cheese, curds, cream, and in less quantities as raw milk, soured milk (clabbered milk, yogurt or kefir), and butter milk (Wilson, 2003, pp. 63, 150-156). Sheep's milk and to a much lesser extent goat's milk were also consumed, however, cow's milk and its by-products were the most widely and deliberately consumed (p. 150).

The archaeological evidence that milk, butter and cheeses were widely consumed throughout England after the 13th century is much stronger (Woolgar, 2006) and by the 14th century the "white meats" (milk, cheese, eggs, and poultry) in varying amounts were staples of the English peasantry (Ross, 1987, p. 27). These "white meats" became especially important after the start of the "enclosures" movement in the 16th century when access to affordable flesh meats declined as Europe's commoners lost access to their land and its animals and moved to urban centres as waged labour (Braudel, 1981) (Wilson, 2003, p. 165). These habits were easily reproduced in the New World by European migrants bringing domesticated cattle with them because of their centrality to the Colonial's diet (McIntosh, 1995). By the nineteenth century, the idea that milk was a nutritious food necessary for the promotion of health and an intrinsic component of a healthy diet was ubiquitous throughout Europe and North America (Frank, 1934;

Hartley, 1842). Dairy consumption was an important component of culture for northern Europeans and their descendants because of the nutritional role milk and dairy products played in their diets (Harris, 1985; Harris & Ross, 1987). Anthropologist Marvin Harris has suggested this importance has to do with the ability of those of Anglo-Saxon and European heritage to produce lactase (one the enzymes necessary for the assimilation of calcium). An adaptation evolved during the Neolithic period as a way of assimilating more calcium and to compensate for the general vitamin D deficiency found among Europeans which is also necessary for the absorption of calcium (Harris, 1987, pp. 80-81). By the early decades of the 20th century the Canadian government continued to promote milk consumption as an affordable source of protein for the entire population (Guard, 2010) (Hanna, 1917) that was, according to Chapin (1907), an interchangeable substitute for meat (p. 194).

It is impossible to separate the decline in access to safe milk from industrialization and urbanization. Milk's passage into infamy began early in the 17th century when milkmaids began ladling milk to urbanites on the streets of London sometime between 1619 and 1641 (Slicher Van Bath, 1963, p. 284). Incident rates of *bovine tuberculosis* rise after the 17th century, and was not known to be a major health problem during earlier times (Cool, 2006, p. 94). In these new urban settings, the dangers of milk were being recognized, and as early as 1745 the British parliament created "boards of health" to ensure that milk from diseased cows was not sold in the marketplace (Hartley, 1842, p. 162). The association between milk and illness was well established, and part of a much larger health crisis in urban centres characterised by poor health, poverty, poor living conditions, crowding and poor housing, poor diet, poor hygiene, poorly designed urban spaces, etc. For the medical practitioner and city dweller alike, the association between milk and illness had been observed since milk was first distributed in urban centres.

Both Bryder (1988) and Slicher Van Bath (1963) point out that some people became ill after drinking milk, but they were typically persons who were already ill, particularly infants and children.

For the urbanite, milk as a drink was seasonal and access limited. Most milk was used to make more durable goods like cheese and butter—primarily because the ability to supply urban centres with large quantities of fresh milk was simply not possible at that time. There are two reasons for this: fresh milk has a very short shelf-life and is only available after the calving season (Slicher Van Bath, 1963, p. 288ff.). It was also more profitable after the enclosures to make cheese and butter for sale in urban centres (Wilson, 2003, p. 165). But, while it was much more practical to sell butter and cheese, these practices created a shortage of fresh milk for urbanites. Pelto and Pelto (1983) observed that rapid population growth and urbanization were resulting in a process of delocalization, meaning that less and less of the diet of Northern Europe's communities was being drawn from its immediate, local producers, but being brought in from ever greater distances both from within Europe and from outside Europe after 1750. The growing distances between the dairy farmer and city dweller, the small numbers of dairy producers relative to population, and the limited ability of dairy cows to produce large amounts of milk per animal were constraints on milk consumption until modern times. These growing distances also made milk more dangerous because of poor hygiene and sanitation practices, a lack of refrigeration technologies, and insufficient transportation infrastructure throughout the commodity chain.

Nevertheless, Robert Hartley of New York was a strong advocate and populariser of milk consumption. Milk in its purest, most wholesome and unadulterated form was considered nutritious and exceptionally good for you (Hartley, 1842) (Montizambert, 1901). Hartley claimed

this long history of dairy consumption was essential to the wellbeing of a "civilized" people, a gift from "nature's author" (Hartley, 1842, p. 497). Other interests were also contributing to the growing desire to drink milk. den Hartog (2001) identifies three possible explanations for the rise in milk consumption after the 1870s: the medical advice given by hygienists to the public, the emergence of home economics classes for girls promoting the use of milk as a drink, and the dairy industry promoting milk consumption in urban centres (pp. 96, 98).

Melanie Dupuis in her book *Nature's Perfect Food* (2002) identifies four reasons for the growing popularity of milk consumption after the 1840s. First, milk as a beverage became more popular in part due to a romanticised cultural view held by urban dwellers who imagined healthy families feeding themselves on fresh milk from the family cow. Her second point was that cow's milk was widely promoted as substitute for breast milk. Early milk crusaders, like Robert Hartley of New York, proclaimed the virtues of consuming cow's milk as nature's perfect food and a preferable substitute for breast milk on the exaggerated claim that urban women were unhealthy because of the unsanitary conditions in which they lived and that breast feeding led to immoral vices, a view popularized by advertisers wanting to promote condensed milk as a healthy alternative (pp. 22, 50-53). The promotion of cow's milk as a substitute for breast milk was following an already existing trend showing a decline in breastfeeding generally. Mepham (1993) argued this decline arose out of the economic necessity of working class women to earn a wage and was subsequently contributing to higher rates of mortality over the course of the 19th century in Britain and the United States. Two pathways were emerging in response to this circumstance. First, as Dupuis argues, was a return to "country fresh" milk coming from dairy animals as a way to ensure children's health.

The second was the development of artificial substitutes—infant formulas—between 1850 and 1910 where the goal was to create formulas that mirrored the fat, sugar and protein content of mother's milk. Medicine contributed by developing proprietary formulas that constituted a patentable and profitable space for the emergence of paediatrics on the claim that the development of infant formulas allowed for the "control" of nutrients, which in their reductionist view equated nutritional components with the health coming from the complete nutrition of a whole food. This allowed doctors to "prescribe" the proper nutritional dosages (Mepham, 1993, p. 226). Moreover, formulas could be sterilised and were thereby commensurate with the ideals and hygiene standards popular at the time (Duffin, 2010, p. 325). Though not mentioned by Dupuis, medical historian Cecilia Mettler (1947) records that the desire for milk also had to do with the common but inadequate practices of feeding children paps and panadas up until around the early decades of the 19th century (p. 710). Paps were diluted mixtures of water, flour and milk used to feed infants when quantities of milk were in short supply. Similarly, panadas had been used to feed infants for centuries. They were pabulums of bread or grains soaked in vegetable and/or meat broths meant to be used in tandem with milk. Beginning around 1465 and becoming popular by the mid-sixteenth century, panadas became substitutes for fresh milk in urban centres where fresh milk was more difficult to obtain. Yet, it was clear even then these were no substitute for milk because infants failed to thrive. In contrast, infants thrived when fed fresh milk and reinforced the view that fresh milk was an essential food for the healthy development of infants and children, but also for the maintenance of health in adults (p. 709; also Mepham, 1993). Certainly, Hartley (1842) believed in the benefits of feeding fresh milk to infants and children. This trend to increase the amount of fresh milk in the diet continued throughout the 19th century as part of the hygienist movement.

Dupuis' third argument was that advertising campaigns for tins of condensed milk may have played a much more significant role (Dupuis, 2002, pp. 50-53). By 1853, Gail Borden's canned condensed milk could be transported long distances without spoiling resulting in its widespread use by the time of the American Civil War (Fernandez-Armesto, 2002, p. 20). Even so, the number of infants fed cow's milk from birth remained low, especially among working women whose finances were limited. This suggests to Dupuis (2002) a fourth class related reason. Breastfeeding declined for upper class women as wet nursing became more popular and for working class women breast feeding declined as they entered the workforce (pp. 22, 50-53). A new middle class began to form after the 1850s creating greater demands for a variety of foods as food prices fell in relation to wages (Harper & Le Beau, 2003, p. 68). The demand for milk became a business opportunity that set out to meet that demand and reflects Appadurai's (1986) view that the emergence of commodities is always a culturally-laden project of transforming desirable products into commodities when there are perceptions of need and there is utility in their distribution (p. 31). That is, as the public's interest in drinking milk grew so did the interest in promoting it as a commodity.

More recently, there has been growing interest in other milk from different species. In developed countries interest is growing in goat's milk, but it remains a "niche" product (Stzalkowska et al, 2009). While goat's milk is more widely consumed in developing countries and there are some studies showing that it may be nutritionally superior to cow's milk, cow's milk is more readily available and affordable in North America. According to Stzalkowska et al (2009), "the production and consumption of cow milk is the largest throughout the world" (p. 311) and has its largest markets in developed countries (Haenlein, 2004). Sheep's milk is interesting because it has a higher protein content, higher fat content, and lower levels of lactose

than cow's milk. These markers are typically considered important when considering milk and its benefits to humans (Kanwal, Ahmed and Mirza, 2004). However, sheep's milk is not widely available. Despite growing interest in other milk, cow's milk is the most relevant to this genealogical study of the metanarrative here in North America.

**State Intervention**

While the associations between milk and illness had been recognised among urbanites since the 17th century (Slicher Van Bath, 1963), the dangers were increasing in urban centres in Europe and North America throughout the industrialising period of the 19th century (Bryder, 1988; Egan 2005). Subsequently, governments were being pushed by some members of the public and the business community to intervene in order to improve and sustain the health of populations. According to Latour (1988), government intervention was becoming more necessary as a way to maintain a healthy working population essential for the continued accumulation of wealth within capitalism (pp. 16-19). Economic growth tied to the processes of urbanization gave rise to the problems of "swill milk". Dairy producers responded to growing populations and the increasing demands for milk throughout the 19th century by moving dairy production into urban centres. This resulted in the proliferation of very unhygienic urban dairies that produced nutritionally empty milk and was subject to contamination (Egan, 2005). This "swill milk", as it was often called, was nutritionally empty because the cows were fed the grains leftover from distilling alcohol. There were 500 such distilleries in and around New York City by mid-century (Giblin, 1986, p. 16ff). Also, cows were crowded into small unsanitary sheds in close proximity to these distilleries, where they lived their lives stood in their own excrement and exposed other sources of disease (Wilson, 2003, pp. 165-167; Wright & Huck, 2002). Hartley (1842) reports this type of production was not just a local practice, but was widespread in the

Americas and Europe (pp. 110, 284-115). Together these practices posed two health problems: (1) the milk was of poor nutritional value and quality and (2) it was subject to post-milking contamination as a result of poor sanitation and handling practices.

In urban centres, the cleanliness of milk became part of the political-scientific agenda and became focused on preserving the purity of milk. That purity, however, has been a mobile construct over the last one hundred years that continues to reconfigure the boundaries between nature and society (Atkins, 2010; Smith-Howard, 2014). The interventions and technologies that once made milk pure have in turn become threats to milk's purity (Smith-Howard, 2014, p. 8). Atkins (2010) similarly looks at milk as an historical construct. He examines a variety of strategies and technological innovations deployed by scientists working in government or in the dairy industry to discover what was "natural" about milk. His focus is on how these actors were using technologies as a way to understand the nature of milk by measuring its properties. This knowledge could then be used to define milk and then police milk using these technologies as techniques of governance.

For Dupuis (2002) the state begins to use science as a way to administer the "purity" of milk and rationalize its production through "experts". For example, the *National Dairy Council* was established in 1915 by the dairy industry to research and promotes dairy products. They targeted children and set up local milk or dairy councils to promote consumption (p. 107). This was in done in response to the persistent sale of "dirty" milk. An 1853 *New York Times* article complains about a Messieurs Johnson and Co. who produced swill milk for an unsuspecting public. His company watered down milk and mixed it with chalk, flour or starch, and molasses to hide its fetid nature. He was one of many whose cows were kept in cramped and unsanitary conditions, often abused, covered in faeces, suffering sickness from a poor diet, and ulcerated

udders. These conditions were said to be the "cause" of 8000 children's deaths annually. The author suggests that an "Association" similar to the ones set up in London to monitor the city's milk supply ("Death in a jug", 1853a, January 22). To address this problem, New York City officials enlisted the cooperation of dairy farmers in Saratoga and Washington counties, some 170 miles from the city, and the *Hudson River Railway Company* in an effort to provide city dwellers with "pure milk" at a low cost. The hope is that the low cost of pure, fresh milk will help to put swill milk operators out of business ("Pure milk vs. Swill Milk", 1853, March 21). Years later, the newspaper reported that swill milk was almost twice as profitable as country milk (New York Daily Times, 1857). The problem was getting clean, uncontaminated milk into the cities. It was 1862 before New York State passed a law prohibiting the feeding of cows with impure foods or keeping them in crowded unsanitary conditions. Two years later in 1864, Massachusetts banned swill milk altogether, and was quickly followed by Pennsylvania, Illinois, Kentucky Indiana (Giblin, 1986, p. 30). However, swill milk was not outlawed completely in the US until 1900 (Block, 2005). Despite these changes, swill milk still represented over half the milk consumed in Cincinnati as late as 1907 (Schmid, 2003, p. 41). Similar laws were in place by 1920s at local and state levels (McIntosh, 1995, p. 101; Harper & Le Beau, 2003, p. 72). The production and sale of swill and adulterated milks were driving most of the discussion around milk throughout most of the 19th century. Raw milk activist Ron Schmidt (2003) has speculated about whether the illnesses associated with unpasteurised milk were actually illnesses coming from drinking these types of milks rather than the problem being the consumption of unpasteurised milk (p. 56).

Eventually, the US Public Health Service drafted the *Model Milk Health Ordinance* and began actively promoting the adoption and enforcement of these regulations, but there were

many challenges, particularly from dairy producers wanting to maintain the status quo. Wright and Huck (2002) argue that the narrative of legislative progress during the Progressive Era when governments enacted health and safety laws to monitor and regulate milk are overstated. Between 1860 and 1940 there was strong resistance by the courts to enforce government laws that regulate milk despite the continuing problems of swill and contaminated milk. There were major organizational problems complicating the assertion of responsibility in liability cases. How to replace swill milk with enough "country fresh milk" that was highly perishable into large densely populated cities had not been resolved. There was a demand for milk that distillery operations were able to fill. Fresh country milk could not be produced in sufficient volume. It was very difficult to get fresh milk produced outside the cities at great distances into the city before it began to deteriorate. If not maintained at the correct temperature, fresh milk quickly deteriorates and becomes a medium for bacterial growth and is susceptible to contamination. This risk increases in a multi-staged production process where many different people would have handled fresh milk. Milk was often left uncovered, stored in unwashed containers and/or left to become too warm. These risks grew as distances increased. Additionally, this milk was also susceptible to the same unscrupulous practices associated with swill milk. To cut costs, businesses covered-up spoiled milk by adding sugar, bicarbonate of soda, chalk, or other substances to cover up the smell and taste of spoiled milk (Wright & Huck, 2002).

By 1900, "fresh milk" travelled an average 105 miles to reach eastern US cities with populations greater than 100,000, and with the exception of New York City, most municipalities were unaware of the conditions under which their cities milk was produced (Jones, 2004). Moreover, Jones writes, as the cities continued to grow the distances milk had to travel would only increase so would the risk of contaminations and bacterial growth. In response,

governments continued to focus their regulatory efforts on the monitoring and cleansing the environments involving milk production and distribution. Pasteurised milk remained unpopular with the public. They disliked the taste, did not believe it was as healthy and unpasteurised milk, and it cost more than unpasteurised milk. This view was not unfounded. Some medical studies were confirming the consumption of unpasteurised milk had better health outcomes. For example, early research in Ohio by Krauss, Erb and Washburn (1933) found the consumption of unpasteurised milk resulted in better growth rates in children and did not result in nutritional anaemia like those children fed pasteurised milk (p. 11). Experiments done by Kramer, Latzke and Shaw (1928) in Topeka, Kansas and Manhattan, New York found adults obtained more calcium from consuming fresh milk than from pasteurized milk, and the levels of calcium obtained from confined animals were even worse. What these sorts of scientific studies did was keep the debates about the benefits of pasteurisation versus general hygiene and sanitary issues on the public agenda.

Public health measures designed to prevent the spread of disease were "widespread and systematic" after 1850 in north-western Europe (J. McNeill, 2000, p. 195). These changes also contribute to the difficulties of assessing how much of the decline in urban deaths could be attributed to the regulation and pasteurization of milk, since after the 1890s other public health programmes centred on hygiene and sanitation and improved water supplies, all leading in part to the improving health conditions experienced by city dwellers (Cutler & Miller, 2005; Lancet, 1914; Wright & Huck, 2002). Chicago became a focal point for this activity because of the public problems tied to the meatpacking industry. By the 1860s Chicago had severe problems with water pollution as a consequence of the stockyards and meatpacking houses dumping waste into the water supply. Even though the city introduced legislation in 1864 seeking stricter

hygiene standards with the building of prototype sewage systems (Wade, 1987), it would be 1900 before the city began to benefit from massive sanitation projects that led to better water conditions. The discovery of typhoid and cholera (diseases also transmitted through contaminated milk) and other infections linked to water resulted in the construction of thousands of filtration plants throughout Europe and North America after the 1880s, but it still would not be until the 1920s and 30s before sewage treatment plants really began springing-up (J. McNeill, 2000, pp. 126-127). The public health response was to undertake large public projects aimed at improving the physical conditions.

Pasteurisation served as yet another tactic countering the consequences industrialisation and urbanisation, which were having an enormous and deleterious impact on the health and living standards of the working poor. Living standards were polarising: mercantilists were growing their profits and gaining more influence over state policy, while poorly paid wage-earners and the unpaid work of women and children created desperate living conditions in urban slums, which among other things led to the widespread distribution of the "white poison" (Atkins, 1992). These debates about how to regulate milk and the social environment continued until the 1940s, but increasingly after WWI pasteurisation began dominating those debates and shifted the momentum away from further regulating production and distribution practices to a focus on cleansing milk (Jones, 2004). The first commercially-operated milk pasteuriser in the United States was set up in Bloomville, New York in 1893. Since then, the focus has been on determining the thresholds of risk and effectiveness of pasteurisation technologies (Holsinger, 1997, p. 441). Determining those risks was difficult and was centred on the duration and temperatures needed to eliminate or minimise pathogenic exposure (p. 442). Westhoff (1978) claims that pasteurisation technologies were first employed by businesses to extend shelf life and

were only later used to by governments to manage public health. Chicago was the first city to legislate the mandatory pasteurization of non-certified raw milk in 1908. The passage of this legislation promptly forced 60 percent of small milk distributors out of business. In 1915, similar laws in Detroit put 68 of the 158 milk distributors out of business within three months. Similar events occurred in Boston and Milwaukee (Levenstein, 2003, p. 41). It was later in 1910 that Chicago banned the sale of all non-pasteurized milk (Wasserman, 1972; W. McNeill, 1976, p. 283). This may be seen as an historical turning point marking an enduring shift beginning the consolidation of our inactions with milk around germ theory and pasteurisation technologies.

**Science and governance**

Throughout the 19th century, science was becoming a more important tool for making health claims about the nutritional content and safety of foods (Mennell, Murcott, & van Otterloo, 1992). Propasteurisers, like Nathan Straus and Adele Hoodless, were also among those gaining prominence, especially in the turbulent years between the 1880s and the 1930s (MacDougall, 1990). It was also a time when politicians, members of the medical community, and business leaders began to reorganise their respective activities accordingly and "settle-in" to these new technologies (Czaplicki, 2007; Levenstein, 2003, pp. 154-155; MacDougall, 1990, p. 204). For the politician these new pasteurisation technologies would become the future technologies of governance. This normalisation of new expert knowledges opens up avenues, according to Miller and Rose (2008), for operationalizing government intervention and makes governance possible (pp. 32ff.). This is accomplished by circulating authoritative narratives and using the law to regulate and (re)enforce those views (Foucault, 2003a, p. 66). Ideas like germ theory transcend political jurisdictions and became the new informational background which governments used to manage and organise populations. This is of particular interest to me

because the connections between politics and science have developed and led to the development of a preventative model of health where the medical management of a population's health depends on the production of healthy citizens aligned with state agendas (Petersen, 1997; Petersen & Wilkinson, 2008). As health claims become prescriptions for preventing illness and managing of populations organised around notions of risk, unpasteurised milk becomes a part of this project.

The view of germs as the specific cause of illness gave hope to the public and politicians alike that the collaboration between the sciences, the dairy industry, and policymakers was possible and could eventually provide a permanent solution to make milk a safer commodity. For example, geographer Aleck Ostry's writings about the development of milk policies in Canada prior to WWII presume the legitimacy of scientific explanations in his analyses (Ostry, 2006; Ostry, Dubois, & Nathoo, 2006; Ostry, Shannon, Dubois, & Nathoo, 2003). So, his discussions about milk usually focus on how the government enacted a series of policies without critically connecting those policies to contested notions of germ theory and/or the efficaciousness of pasteurisation technologies. This political activity contributed to the stability of the metanarrative and the continuation of milk policies that uncritically accept of what Kurtz (2013) calls "Pasteurian science". It simplified the types of political response, and instead of continuing to emphasise management of the totality of socio-environmental conditions in which milk was produced, it became possible to focus on the elimination of specific causes (Latour, 1988, p. 48). It was a technique of government to project onto milk a view that the relationship between disease-causing pathogens and human illness has become a calculable, manageable, non-risky relation because scientists now understand through the processes of discovery the dangers of

consuming milk and how to control the number of disease-causing pathogens through the technologies of pasteurisation.

One way the state protects the metanarrative is to reduce the debates around milk to a simple choice between pasteurised and unpasteurised milks. This strategy effectively reifies the view that milk needs to be germ-free to be safe. I mention at least eight types of milk throughout this project that I have found used in the various texts I have read. These are not legal definitions. There are those types of definitions as well, found in government documents regulating the production, distribution, and storage of commercial milks. However, these types of definitions only reify what is already believed about the relationship between milk and illness and do not contribute to our understanding of how the metanarrative was constituted through the struggles between pro- and anti-pasteurisers. When different types of milk are distinguished, it becomes possible to ask different questions without appearing nonsensical, or being forced into simplistic either/or distinctions that often get deployed by scientists and politicians to justify the claim that pasteurisation should be made mandatory.

Briefly, the list of different types of milk begins with *certified raw milk*. This refers to unadulterated, disease-free milk, usually organic from healthy cows that are typically, though not necessarily, pasture fed. *Raw milk* is any milk that has not been pasteurised or homogenised. Today this type of milk is traded commercially. Milk of this type comes from any number of dairies and is collected and transported to pasteurising/sterilising facilities where the milk is pooled together to be heat-treated, fortified and homogenized. This form of milk cannot be legally sold for human consumption because it may or may not be disease-free. *Fresh milk* refers to milk that is also raw, but perceived by the public as safe to drink and locally produced. There was a false sense of security surrounding this description of milk that most often is used prior to

WWII, since distributors and producers often made claims about the "freshness" of their product, which may or may not have been regulated or regulated properly. Third, *contaminated milk* refers to milk contaminated after milking by any number of disease-causing bacteria, especially during the handling and distribution of the milk. This milk may or may not start out as organic. Diseases like *Salmonella*, *brucella*, *pseudomonas*, *yersinia*, *campylobacter*, *staph* infections and *listeria monocytogenes* are all food-borne diseases introduced during and after milking or passed through the milk of sick cows. These are not diseases inherent in cow's milk; they are the result of contamination and thrive in an industrial model of milk production, but also on farms where there are poor sanitation and hygiene standards and practices. *Tubercular milk* refers to milk infected with a form of bovine tuberculosis that may be transmitted to human beings by consuming milk drawn from tubercular cows. Seven, *adulterated milk* could be fresh, raw, contaminated, or tubercular that has been subsequently altered by adding substances after milking to hide any defects in the milk, usually done to extend the shelf life and increase profits, and was a tactic used by many milk sellers throughout the 19th century as they moved milk into urban centres for sale. Swill milk is a historically specific form of contaminated milk that was often adulterated and produced in very unhealthy and unsanitary conditions. Dairy cows were co-located with distilleries and fed the effluent grains used in the process of making alcohol. Finally, there is *pasteurized milk*. It is milk that has been heat-treated and may or may not be milk that is adulterated, tubercular, organic or non-organic, or contaminated.

The first seven categories of milk often get juxtaposed with pasteurised milk once the notion of pasteurising milk became accepted. These categories of milk raise important questions. Was fresh milk the problem because it was contaminated rather than because it was unpasteurised? Did the introduction of pasteurisation really result in fewer deaths because it

protected milk drinkers from tubercular milk or was the crisis due to contaminated or adulterated milk, or some combination of all three? How were these categorised, recorded and tested by medical authorities? The answers to these types of questions are not clear and they remain unclear and contestable because these terms were often not well defined, and their usage is not consistent among authors but show up in discussing different historical texts to discuss a particular issue surrounding milk. I have, therefore, drawn these "definitions" from the readings only to make the point that binaries hide the contested views that surround milk. This strategy reinforces the notion that science is a neutral and necessary arbiter of truth, rather than an authorised and authorising a type of discourse that organises a particular type of consensus that oftentimes devalues human experience, heritage and tradition, and replaces them with institutionalised expert knowledge regimes (Belton, 2003; Ilcan & Phillips 2003; Millstone & van Zwanenberg, 2004). The choice to drink unpasteurised milk safely is marginalised and made less acceptable—a seemingly irrational and irresponsible lifestyle choice in the face of established expertise.

# INTRODUCTION: PART II

## Constituting Milk as Nutritious and Safe

> The factization of the world is a human activity. (Hacking, 2002, p. 65)

> Knowledge is powerful in ways which may not be immediately obvious to those who fabricated it, that knowledge which 'explains' reality is dangerous, and must be treated with caution, lest it overwhelms those who create it, and those who are its subject. (Fox, 1994, p. 1)

This project is about problematizing the metanarrative that configures milk. It is an effort to understand how and/or what discourses inform and informed how pasteurised milk is and was constituted as a safe and nutritious food. My focus is on how milk was and is constituted through scientific claims. Specifically, I examine how emerging medical theorizing and ideas about appropriate medical interventions intersect(ed) with economics and politics to coordinate and formalise institutional realities that are subsequently used to organise people's relationships to milk. This is important because how foods are conceptualised using science has policy and political consequences. A useful way to enter that examination is not through the reified lenses of institutionalised understandings but rather to employ a genealogical approach that "disturbs what was previously considered immobile" (Foucault, 1984, p. 82) and that unpacks the accepted-acceptable views of propasteurisers and the propasteurising state to reveal their contingencies. The starting place for this type of analysis is with the marginalised and/or subordinated claims and events circulating at the margins of these debates (Foucault, 1980, pp. 96-99). I use the genealogical method to problematize how institutionalised views of a germ theory of contagious disease and the nutritional sciences, while operating as the primary sites for comprehending and homogenizing society's relations to milk, were or are themselves sites of controversy. These sites represent unstable medical accounts that were vigorously contested by medical practitioners and researchers up until the time of WWII, but they are now mostly contested by a small group

of marginalised raw milk activists. A genealogical analysis is useful because it collects instances of contestation that can be used to show in what ways the metanarrative was or remains unstable. This type of analysis matters because this metanarrative is still operating and influencing the production of public law and policy. My starting place for problematizing the metanarrative then begins with the marginalised experience of the raw milk activist and their claims about the health benefits and safety of drinking raw milk.

Each paper in this project is written as an independent article and contributes to this genealogical investigation in different ways. In each article, I focus on a different discursive and unrelated set of problems that contribute to the formation and/or continuation of this metanarrative. Together the three papers do not represent a singular cohesive narrative, yet they speak to each other through a broad, common aim to examine how medical science generates, authorises, and privileges stable scientific explanations that align with emergent economic and government interests operating within specific historical environments. In the first two articles, I achieve this by problematizing some of the historical circumstances that produced the metanarrative. In the third paper, I look at how raw milk activists and the propasteurising state currently debate the limits and prescriptions of the metanarrative.

By examining some of the circumstances that contribute to the formation of the metanarrative, I aim to develop a sociological sense of how medical claims emerged to regulate life while remaining contested. This is my contribution: to see public interactions with milk as primarily an expression of medicalised discourses about nutrition and safety configured within discursive social contexts—to see that there is no direct experience of drinking milk and to recognize that the experience of drinking milk is mediated in particular ways that satisfy particular interests and beliefs about the "nature" of milk. It is a refusal of scientism in which the

only legitimate knowledge arises from the positivistic view that scientific method produces "facts" and it no longer needs to reflect on or give an account of the epistemological conditions under which facts are produced.

The production of scientific knowledge occurs within social contexts that are affected by economic, political, and scientific agendas. To unpack these processes, I use Foucault's genealogical method as a form of critique that problematizes the conditions under which beliefs and circumstances are produced in order to better uncover their contingency and complexity (Koopman, 2013, p. 16ff.). My conceptual starting point is Foucault's view that our thoughts and beliefs about the world are a consequence of the relationships between systems of power and knowledge where power operates through accepted forms of knowledge and scientific understanding: this is the power-knowledge nexus (Foucault, 1980). The metanarrative formed around milk is a consequence of this power-knowledge nexus, therefore, the goal is to show how scientific claims about milk emerge as interpretative accounts that normalise the experience of drinking milk in ways that matter to "us" today. These interpretations constitute the metanarrative that has been subsequently deployed as a template to coordinate public attitudes and beliefs in Canada and the United States about the value of drinking a nutritious glass of milk and to facilitate the implementation of pasteurisation technologies in order to safely mass-produce and distribute pasteurised milk as a commodity.

How scientific ideas get privileged institutionally, I argue, depends on their utility on two levels. One, the theory itself must create logically coherent explanations that provide an account of our perceptions and experiences. Second, there must be the capacity to develop technologies that can be implemented to satisfy a range of cultural, economic, and political interests. My analysis is a critical examination of how science, as a useful knowledge-producing activity,

defines milk discursively from within existing politicised social environments. That is, I accept science is a socially constructed practice that, in its attempts to manage and understand the world, produces uncertainty.

That scientific practices produce this kind of uncertainty finds support in some of the work done in the field of Science, Technology, and Society (STS). As a body of critical research, STS scholars have established that there is a social component contributing to the production of scientific claims and explanations. I agree with Latour (1983, 1999), Latour and Woolgar (1986), Knorr-Cetina (1983, 2005), and Woolgar (1988) that the application of scientific method does not produce unmediated insight into a concept-independent reality. Woolgar's book *Science: The very idea* (1988) contributes to this idea that science is a socially influenced practice by focusing on the problems scientists have in applying scientific method and drawing conclusions from its application. Woolgar argues that it is not possible to separate scientific activity from social influences, in which case science is not just a process of discovering facts (p. 97). The work of Latour and Knorr-Cetina, alternatively, examines the difficulties scientists have, particularly those working in laboratory conditions, in constructing facts and developing convincing and stable scientific explanations. Latour (1983) looks specifically at laboratory practices and criticises STS scholars for ignoring the non-scientific practices, the opportunism, the influence of economics and politics, and the internal "laboratory folklore" that circulates within scientific communities and effects how scientific knowledge is produced.

These types of criticisms are related to Bloor's (1991) outline of the so-called 'strong programme'. In it, he creates a set of criteria for undertaking a study in the *sociology of scientific knowledge*. Sismondo (2010) has summarised the strong programme as the study of science and technology in social and cultural terms (p. 55). This constructionist view of knowledge is

characterised by three assumptions: that scientific knowledge has a social component that influences how facts are constructed, that understanding is actively under (re)construction as understandings change, and that "the products of science and technology *are not themselves natural*" and do not reveal some direct experience of reality (p. 57, emphasis in the original). Bloor (1991) does not suggest, however, that 'science as social' in any way means that the production of scientific knowledge is merely social. Rather, the social is a constitutive component in generating scientific knowledge about reality: the two cannot be conflated or reduced to one another (p. 166). This kind of criticism is ongoing and reflects the indeterminate nature of constructing scientific representations. This has similarities with Foucault's view that representations of "reality" are arrived at discursively and not given. The criticism often levelled at scientists is their inability and/or unwillingness to reflect critically on "the nature of their practice, its contingences and limits" (Wynne, 2003, p. 43). Scientists, Wynne suggests, deliberately ignore the epistemological issues about the purposes of the knowledge they produce and what counts as "sound knowledge" within different social circumstances (p. 43).

Irwin and Wynne (2003) point out that science is social in two ways. The first is the important role science has in coordinating public debate (p. 2). This issue will be addressed below in the section titled "Nomadology within the genealogical arc," where I refer to the work of Jones and Irwin (2010) and Wynne (2003). In my third paper, instead of using an STS approach to examine this issue, I use a form of discourse analysis (DA) to look at how scientific discourses circulate in ways that enable and constrain public debates about milk. The second way in which science is social rests on the view that scientific claims and explanations are socially situated and "framed by unstated social commitments" (Irwin and Wynne, 2003, p. 2). A

genealogical unpacking of this relationship between the social and the bodies of knowledge is the focus of my first two papers. That analysis exploits the work done in STS.

Actor Network Theory (ANT), an important theoretical approach within STS, has been used to show that the construction of scientific theories and explanations are socially constructed and emerge within complex social process (Latour, 1987, 1988). In *The Pasteurisation of France*, Latour (1988) suggests the successful implementation of Louis Pasteur's germ theory was the consequence of a convergence with other social forces and interests, such as the hygiene movement. Grint and Woolgar (1997) also examine the roll of the social in their work discussing the deterministic role social contexts have for interpreting events like being shot. Being shot cannot be reduced to a technical description of a bullet penetrating flesh. The causes of being shot and the interpretation of those causes are entirely context-dependent (pp. 140ff.). In a different, more technological context, Bijker (1995) looks at how technologies are adapted to and shaped by social convention.

The work being done in STS demonstrates a need to reimagine science as a social activity. Work by these scholars reveals that those attempts to produce stable representations create conditions of uncertainty about what can be known. It is amid such uncertainty that discourses circulate and establish relations of power that not only contribute to the formation of the metanarrative but also operate through it. The view that science is social has a parallel in the work of Foucault. There is a relationship between systems of power and knowledge in Foucault that is discursively produced by discourses within social environments (Foucault, 1980). The emergence of pasteurisation technologies was highly dependent on how scientific explanations emerged under context-dependent historical circumstances. However, that does not mean that discourse and discursive activity are solely affects of discourse. I will address the relationship

between discursive and non-discursive in the *Theory and Methodology* section. At this point, I want to emphasise the importance that these contributions coming from STS have in grounding my genealogical approach. I do not intend to engage or contribute to those debates in STS about how science operates to produce stable scientific accounts. Rather, I accept their findings that scientific accounts are socially constructed attempts to produce scientifically stable representations. I use that body of work as evidence that science produces uncertainty and that uncertainty operates as a discursive space where discourses circulate about how milk safety should be conceptualised and managed. These uncertainties are ordered within particular sets of historical and epistemological circumstances. To unpack the uncertainties that contribute to the formation of the metanarrative, I employ a genealogical analysis of the discursive conditions that were circulating, as relations of power, to produce this type of "socio-scientific" activity and its subsequent uncertainties.

The articles in this dissertation also contribute to and connect with discussions about what are healthy foods and what constitutes a healthy diet. Turner (1982a, 1982b), for example, provides two very interesting analyses about the importance ideas have in the early formation of the dietary sciences. Each article discusses how those ideas were taken up as rationalised medical regimes that worked to authorise particular notions of what constituted and continues to influence current view about what constitutes a healthy diet. In a more contemporary context, Dixon and Banwell (2004), Ilcan and Phillips (2003), and Nestle (2002) discuss how the sciences of health and nutrition align with economic interests and are used as a map for coordinating food policy and enforcing the kinds of foods that are produced. They have concerns not only about the influence business activity has on politicians and the administrative institutions that regulate our foods, but also how science and politics work in support of business agendas. Nimmo (2008) and

Paxson (2008) each consider how non-human actors, like the bovine tuberculosis bacterium found in milk, create the political-social conditions for regulating the non-human world, and how scientific knowledge of microbes sets the tone for reconfiguring human interactions around milk. These types of analyses, ranging from examinations of how ideas about dietary regimes got formalised to the politics of subsidizing particular types of milk production, suggest that all scientific regimes of knowledge operate as sites of power that produce contestable and negotiable claims about the foods we eat.

How foods are defined and made acceptable must take into account a range of interests. A genealogical unpacking of how scientific regimes of knowledge define milk matters because scientific theorising and practices continue to dominate the contested spaces of the metanarrative. Scientific theorising and practice has an increasingly determinative role in prefiguring how the public should interact with foods such as milk. Science determines how milk is produced, what defines it as a nutritious food, and how milk should be regulated and made safe through government institutions. These practices are then reflected in policies such as the dietary guidelines recommending fat-free or low-fat milk that is high in calcium and low in saturated fat (Nestle, 2002, pp. 79-81). No policy regulating food simply regulates the distribution of "naturally-occurring", unadulterated and/or unprocessed foods (Maxwell & Slater, 2004) (Nettleton, 1997) (Tunick, 2009). Rather, food policies project attributes onto foods that fulfil historically specific interests and needs. Generating public policy, therefore, is a complex political task and is a process of abstracting sets of regulations from the concrete experiences of everyday life, usually in response to some crisis or as a precautionary measure, and then applying those regulations to the broadest set of circumstances. It involves the interaction of many actors including bureaucrats, business people, special interest groups, medical

professionals, politicians, and research scientists operating within the constraints of different social, institutional, and organisational arrangements. Each of these actors have their own points of view, yet work within institutionalised settings that also have their own institutionalised narratives and modes of thinking peculiar to its point of view. The regulation of milk is no exception to these processes.

The production of scientific knowledge and its systematic use as a way for organising social relations has generated some unintended and undesirable consequences that science is increasingly unable to correct. This has resulted in a backlash against politics too dependent on science (Redner, 2001). Beck (1992) describes this reliance on science to shape public policy as the scientization of public discourse. The public's dependence on expert knowledges and technological innovation becomes inescapable and further distances the citizen from democratic processes and the ability to assert a measure of control over their own lives. According to Turner (1982b), this dependence increases the intensity of political intervention as more knowledge becomes available and opens up new avenues for intervention (Turner, 1982)—what Beck (1992) calls a double shock for the public. While the public experiences the risks associated with the consumption of milk, they also experience the loss of control over how to identify and assess the benefits or threats to them without deferring to institutional experts acting as the gatekeepers of knowledge and legitimate practice (Hacker, 1998).

Calculations of risk are a gatekeeping mechanism that glosses over the difficulties scientists have in developing theories that describe and explain our perceptions of reality. These difficulties remove understandings of risk from the realm of direct experience and reconfigure reality according to a theoretical construct. This practice is inherent in the biopolitics of the New Surveillance Medicine where the conceptualisation and management of risks become the

foundational orientation for managing the health of individuals (Armstrong 1995). Skolbekken (2008) argues that the calculation of risk within medicine plays a central role in how reality is ordered precisely because scientists have an indeterminate understanding of causality. Notions of risk are representations derived from probability calculations about the potential threats to health (pp. 17, 19). The result is a *culture of risk* characterised by perpetual uncertainty and anxiety (Rose, 1999, p. 160). The dangers associated with drinking unpasteurised milk are similarly ordered by scientific accounts that generate probability assessments about the probable risks to the public. Therefore, scientific accounts and the public presentation of these accounts reduce the perceptions of risk from a probability assessment to a categorical view that unpasteurised milk is an "inherently" dangerous substance. Those cases that fall outside the parameters of the statistical model are ignored as outliers.

Giddens (1990) would then describe medical theorising and pasteurisation technologies as "disembedding mechanisms" because they are used to organise social life by removing the non-expert from the immediacies of his or her context. More than this, the disembedding process formalises the gap between medical explanations from the diversity of local experiences and creates conditions of distrust (1990, p. 25ff.). Distrust of these disembedded knowledges becomes a reason to resist scientific claims. Irwin and Wynne (2003) similarly discuss this issue of credibility and trust in relation to science. They suggest that the deficit in public trust in science is not rooted in the inability of the public to understand science. Rather it is rooted in the lack of reflexivity in science when it advances its explanations (pp. 7-10). Scientists tend to present scientific findings as unproblematic and do not question "its epistemic commitments, social purposes, institutional structures, intellectual boundaries and relationship with 'non-science'" (p. 4). In failing to acknowledge this epistemological and ontological uncertainty, the

normative influences on public policy are marginalised and ignored. As a result, trust declines. The regulation of milk is no exception to these processes.

Scientists often make categorical claims about the dangers of unpasteurized milk while glossing over the statistical improbability and uncertainty of that risk. This aligns with Wynne's (2003) broader view that science ignores the uncertainty inherent in generating statistical assessments in favour of presenting categorical assertions produced under the assumption of a context-independent reality to the public. Epistemological slippages appear in the debates between propasteurisers and raw milk activists because scientists define milk as an inherently risky food that is in opposition to activists' own experiences of drinking unpasteurised milk safely.

The defining and measuring of risk is an important aspect in gauging the safety of any milk. There is an important body of scholarship discussing the concepts and debates around risk. Douglas (1983) and Lupton (2013b) are examples. Any discussion of milk will be affected by how risks are conceived and defined by theorists. Different theoretical conceptualisations change the analyst's approach and perceptions about whether milk is an inherently risky food or whether perceptions of risk are social interpretations organising differently around a hazardous food. Douglas (1983) argues that as scientists try to understand the world, they unintentionally widen the gap between what is thought to be known and what is desirable to know (pp. 3-5). This gap in knowledge creates perceptions of risk that cannot be resolved scientifically. Therefore, culture determines what is risky, and science, working in hindsight, generates explanations and ways to manage those perceived risks (pp. 6-9).

How science undertakes that task is bound to how human beings conceptualise the world around them. A typical way to do this is to create binaries as a way to explain human

engagement with the 'other'. Science versus culture (Enticott, 2003; Lupton, 1994; Nestle, 2003) and science versus nature (Murdoch and Miele, 1999) are common oppositions used to frame discussions of risks around food. Imagining binaries as markers of otherness is essential for ordering and making claims about the world (Lupton, 2013b, p. 174). Nature is often represented as the unruly, meaningless other that is contrasted with the efforts of cultures and/or science to order the world and give it both meaning and utilitarian purpose (Murdoch and Miele, 1999). It is this utilitarian view of nature that, according to Eder (1996), dominates politics and business as they seek to globalize and standardize food production. However, this dominant view is confronted by local, differentiated forms of production that resist those industrial practices in an effort to protect nature because they see it as a source of "goodness" (Murdoch and Miele, 1999, p. 466). This view of protecting and preserving nature is bound up with the perception that unrestrained industrial models of food production are destroying nature and subsequently contributing to declining levels of health. Efforts to preserve that goodness and the health of the public becomes a discursive space where scientific support for industrial practices and "lay epistemologies" grounded in local experience and culture emerge to contest how risks are produced (Enticott, 2003). Nutritionist Marion Nestle, in her book *Safe Food* (2003), similarly frames her argument about risk as a binary that contrasts science-based views of risk with value-based views of risk (pp. 16-22). The framing of arguments through binaries reduces different points of view to simple oppositions that, as Enticott points out, hide the complex social, political, and scientific contexts that produce those concepts of risk. Nevertheless, both Enticott and Nestle reach the conclusion that risks should ultimately be interpreted by scientists because they are capable of establishing scientifically precisely what the risks to the public are because

the application of scientific methods makes the world knowable through the application of scientific method.

What matters to me in this project is not whether science has a legitimate role to play in comprehending the world—it does—but rather how science understands and comes to know what is risky in relation to the hazards that are coming from nature. Fox (1998) discusses three different views of how risks and their relationship to hazards can be thought of differently. The first suggests that views of risk are reducible to the "real" hazards coming from dangerous foods. Views of risk correspond with the experience of a hazard. That is, it is the naïve view that something is risky because it is a hazard. This is consistent with Lupton's presentation of the technico-scientific perspective that assumes a naïve realism (2013b, p. 49). Naïve realism is the view that science has access to a context-independent reality that scientists discover or are yet to discover. According to the second view, hazards are part of the natural order while risks as interpretations are value-laden judgements. This seems to be the view of Enticott (2003) and Nestle (2003). It is the weak constructionist view that risks are "mediated" by socio-cultural processes (Lupton, 2013b, p. 50). These debates and interpretative accounts of risk are produced by making appeals to the hazards found in nature.

In contrast to these two positions, I adopt the view that hazards are also contextual and discursive. Therefore, I am interested in how science comes to understand what is risky and also what is hazardous. Thus, like Fox (1998), I see hazards as socially constituted. Fox's third postmodern/poststructuralist position, which he favours, is that both risks and hazards are socially constructed ideas. This strong constructivist position focuses on how realities are constructed and given meaning within the power-knowledge nexus (Lupton, 2013b, pp. 38-39). Hazards, according to Fox, are no longer prior to nor isolated from our understandings of risk.

Rather, there are risks for which hazards are generated in order to verify the judgements people make about the risks they experience. According to Fox (1998), views of risk and hazard are both socio-cultural products. This view is consistent with Wynne's view (1996) that scientific knowledge is a social product (p. 60). Throughout the dissertation, I maintain that hazards are a social construct. This is consistent with my opening question about whether scientific knowledge is just politicised or is already political. In addition, hazards as a social construct orients my genealogical analysis of the discourses that discursively organise the threats associated with milk.

It matters how we order the world using ideas. How it is ordered in the present, how it was ordered in the past, and how it is reordered through efforts to order the past in ways that matter to us in the present create historical precedencies. A genealogy can bring those moments of contestation to the forefront and present them as important instances that destabilize the metanarrative. However, critiquing the metanarrative is not necessarily an argument for its dismantling. Metanarratives serve an important purpose for ordering the world and creating the conditions necessary for action (Deleuze and Guattari, 1987, 1-25). However, they need continuous critiquing in order to ensure their worthwhileness.

West (2008) points out that raw milk activists are not just making a cultural argument for the right to drink raw milk. Their activities and claims cannot be reduced to any one binary. They are engaged in a sophisticated challenge of science. Certainly, I see cultural concerns about the survival of the family farm and preservation of local sites of production as part of their agenda. However, the primary issues are about physical health and about the right to control their bodies when it comes to providing for their own health. To that effort they are using existing science to mount their challenge. Raw milk activists are studying the scientific literature as well as making

alliances with healthcare professionals and researchers in an effort to make their case. The current metanarrative positions contested points of view as anti-science and as a rejection of empirical evidence. However, raw milk activists accept that there are risks to drinking raw milk. Some raw milk activists and groups argue that the "actual" hazards attributed to milk are also problematic assertions by scientists: different scientific studies can be used to make a "scientific" case for drinking raw milk safely. They are not calling for the withdrawal of scientific intervention. Rather, they imagine scientists and governments seeing raw milk differently and creating policies that include raw milk activists within the democratic process.

To foster these democratic processes, Nowotny (2003) suggests there is a need for a different kind of engagement between scientific expertise and the public has never been more necessary as a way to solve society's complex scientific-technical problems (Nowotny, 2003). Nowotny (2003) suggests that the problem with using science in that role is that there is an inherent "trangressiveness" of scientific expertise as experts, when called upon to solve society's complex problems, "are forced to transgress the limits of their competence" and draw inferences across a number of fields that transcend their own disciplinary competence (p. 152). I see scientists operating within *inferential networks of knowledge* where scientific knowledge is being taken up paradigmatically as part of an attempt to harmonise scientific theories, technologies, politics, and economic interests so that action becomes possible (Speake, 2011). There is no logical necessity inherent in any particular outcome. Rather, scientific claims about milk are constituted within discursive and non-discursive spaces that are subject to interpretation from within existing social circumstances.

The science and technologies produced by these experts are not just benign expressions of human achievement. For Beck (1992), science itself is a source of future risk that further deepens

the public's reliance on scientific claims but also turns scientific information into a disciplinary technology used to rationalise certain kinds of behaviour at the expense of others. These disciplinary techniques cultivate distrust among raw milk activists about how science is being deployed by state agencies to preserve a particular set of rationalities and practices. Although scientific claims tend to become hardened as a particular hegemonic form, there are in fact competing, contradictory, and inconclusive claims coming from within the scientific community. Public health officials and policymakers selectively take up these claims to determine state policy that subsequently cast doubt on the claims of activists that drinking unpasteurised milk has contributed to their health and is safe. For activists, there is a crisis in legitimacy. The persistence of these issues in the public discourse has given new energy to a growing number of individuals demanding legal access to safe unpasteurised milk despite the overwhelming "consensus" within and among government agencies, the medical community, public health organisations, and the dairy industry that consuming unpasteurised milk is unsafe and not necessary for the maintenance of health.

**Organisation**

This is a paper-based dissertation. This project consists of three separate papers that stand alone as articles of published and publishable quality. Each paper is a self-contained discussion of some aspect of the past and present controversies around the value of pasteurising milk. The papers do not represent a chronological unfolding of events or a single analytical narrative coordinated systematically through a single theoretical-methodological lens. However, taken together each paper points to an issue that I think represents the importance scientific ideas, political action, and economic necessity have in coordinating the various experiences of drinking milk. In that sense the overall arc of the project is genealogical: a mode of inquiry developed by Foucault to show that the complex processes of history cannot be subordinated to a single

generalised account. For that reason, I chose three specific and very different sets of problems that arose in the long history of drinking milk. In each paper I sought to problematize some aspect of how past and present beliefs about milk were or continue to be constituted in ways that speak to the unstable and contestable nature of scientific theorising and the efficaciousness of the technological interventions.

In that effort, the first paper examines the problems associated with the emergence of germ theory as a causal explanation of disease formation and the diagnostic difficulties associated with it during the 19th century and early decades of the 20th century, particularly as germ theory would redefine milk as an inherently dangerous food requiring scientific oversight. The second paper, published in 2011 in the journal: *Studies in History and Philosophy of Biological and Biomedical Sciences*, focuses on how germ theory was deployed during a similar time period to causally link germs, milk, and human illness and then used as an institutionalised theoretical lens for managing the health of populations. The third paper jumps to the present and looks at how scientific explanations are deployed in the debate between raw milk activists and the propasteurising state.

What follows in the first part of this introduction are sections discussing my research agenda as well as my theoretical and methodological approach to this project. At the end of Part I of the introductory chapter, I provide a more detailed overview of each paper to clarify its importance and explain what I think each paper accomplishes. In Part II of the Introduction, I provide some interesting historical background to this project. This section begins with a very brief overview of the contradiction between the state's propasteurising message and the laws enacted by the same state that allow for the consumption of raw milk. It is this context that motivated me to look deeper into the dangers of unpasteurised milk. The sections in Part II then

review the historical importance milk has had in American, British, and Canadian cultures that would not be abandoned as the linkages between drinking milk and illness really crystallised as a growing urban problem beginning early in the 17th century (Slicher Van Bath, 1963). This history sets the stage for the need for medical science, politicians, and the public to respond to a growing crisis around milk that was mostly effecting infants, young children, and the infirm (Bryder, 1988). The papers follow Parts I and II of the Introduction and make up the body of this text. The concluding chapter is a short distillation on the significance of this research agenda and it discusses some of the future possibilities this type of analysis holds for understanding the scientization of our relationships to food by examining other controversial linkages between diet, nutrition, health, and foodways.

**Research Agenda**

The basic unifying theme throughout this project is that interactions with milk are subject to the discourses circulating through the medical sciences and that the metanarrative is coordinated using contested science that itself was constituted and operating in particular historical environments. The emergence of the nutritional sciences and the germ theory of contagious disease in the 19th century are the two events that significantly changed how the public perceived milk. It meant milk had to be cleansed of germs. That was made possible by the subsequent development and availability of pasteurisation technologies. The introduction of pasteurisation technologies gave rise to other debates about whether pasteurised and unpasteurised milk were nutritional equivalents and the public health issue of trying to determine how “clean” milk had to be for it to be safe to drink. As a social activity, albeit a specific form of activity, science is valuable because it is a useful tool and operates as a potentially self-correcting process, but only when subject to critique from within and without. Sociologists, therefore,

should not treat science as a "black box" generating truths that is walled-off from inquiry or economic, political, and/or social influence.

Here I agree with sociologist Troy Duster (2006) that scientific claims should not be accepted uncritically. Sociologists have an important role in supplying the context for scientific claims. Therefore, sociology is a discipline useful for exploring the gap between scientific representation and experience as well as reminding policymakers of the importance of querying reductionist claims without reference to the social. Duster suggests this reductionist trend will continue to gain legitimacy and sociology will become irrelevant if sociologists continue to side-line themselves by simply accusing all sciences of being a socially constructed phenomenon without interrogating how the relationship between the physical and the social is constituted. According to medical sociologist William Cockerham (2007), postmodernist critiques of medicine have had little success or influence on medical theorising and practice because postmodernists treat society as "fractured, unstable, and incoherent" and see science as just another form of discourse. Medicine sees this orientation as essentially appealing to marginalized concerns and it is relegated to "niche areas" of concern. Critics of the postmodernist approach argue that it fails to explain change, is jargon-laden, and is beyond offering a method of deconstruction. Therefore, the postmodernist approach offers little help to medicine for reconfiguring its theories or practices. In this view, sociology only has value if it employs a functionalist paradigm confined to exploring the socially determinative causes of illness, and it contributes to medicine's understanding of how the social contributes to the onset of disease and/or illness. For sociologists to contribute meaningfully, Cockerham suggests they need to provide some practical insights that can be incorporated into medical theorising and practice. This is clearly one role for sociology. However, as Duster points out, the challenge is also to act

as a destabilising force that challenges medical theory and practice by analysing how theories emerge as well as how categories, systems of classification, and metrics are developed and deployed to organise social life and configure public policy. These are essential aspects of critique and do have—at least tangentially—a practical impact on how medicine is practiced and, particularly, how individuals are disciplined using science-based understandings of nutrition and health.

My own approach may be construed as postmodern-poststructuralist if postmodernism is simply defined as an interest in social relations that are "*constituted discursively to serve particular interests of power, and contested by other interests of power*" (Fox, 1994, p. 49). This view of postmodernism may be characterised by a rejection of metanarratives, absolute truths, and the view that linguistic representations are precise descriptions of reality (Blaikie, 2007, pp. 48-49). These claims have strong connections with the work of Foucault and his arguments that knowledge claims and systems of power are intertwined and constitute one another (Foucault, 1980). This poststructuralist orientation to understanding social relations and the production of knowledge claims set the stage for formulating my two interrelated research questions that ultimately guide this project:

1. How did scientific ideas become privileged?
2. How has milk been constituted and contested as a dangerous food?

Taken separately, these questions are ridiculously huge and ambiguous projects. However, taken together they move me along a process of examining how science operates as a mechanism of power that privileges certain kinds of scientific explanations to examining how those ideas configure milk at different moments in time. Of interest is how scientific ideas find their merit in the capacity of scientists to translate their explanations into actionable solutions within social

environments. Only a particular type of explanation has scientific merit and that limitation introduces uncertainty about what can be known. Since the first question sees science as a social activity that introduces uncertainty, then it follows, in the second question, that our interactions with milk are configured through time in specific social-scientific environments that also produce and reproduce uncertainty. Therefore, if science is a process of constituting and privileging specific kinds of explanations, then it produces openings that invite examining those contested moments in the history of milk that gave rise to the beliefs we have about milk today. Together, these two questions focus my analysis of the metanarrative on the role science was and is playing in the formation and reproduction of it.

The first research question is a very general question about how some scientific explanations come to represent the scientific consensus while others do not. Science is a process of erecting conceptual boundaries between privileged and unprivileged as well as legitimate and illegitimate knowledges. Science distinguishes itself from other forms of explanation by its ability to schematise causal explanations and incorporate those causes into a coherent body of knowledge by appeals to evidence. However, as Lambert and Brittan (1992) point out, one of the perennial philosophical problems for science in general is that of determining what constitutes a scientific explanation that differentiates it from other forms of explanation. Scientific method itself is a construct; there are logical and evidential problems inherent in the performance of science that mark them as sites of structural contestation.

For example, in a germ theory model of contagious disease, the premise that a specific germ causes a specific illness can only be demonstrated by collecting cases that show a statistical correlation between the presence of germs and ill people. To properly show a causal relationship between germs and illness, a reversal in the deductive order of the premises should also be true.

That is, if germs cause illness, then whenever people are exposed to germs they must fall ill. Of course, this is not easily demonstrable and to my knowledge there are no studies showing a statistical correlation between a population exposed to germs and that portion of the population that did not become ill. Germ theory cannot fully explain why people do not become ill when exposed to similar germs as those that do. This is why I have discussed germ theory as not only a very useful theory, but one that has had great difficulty explaining the randomness of infections, determining the virulence of germs, or explaining how germs interact with their environments (Speake, 2011). The practice of statistical modelling is used as a strategy for overcoming these shortcomings; however, statistical models cannot in any way suggest which outcomes are more valid (Lambert and Brittan, 1992, pp. 9-50). That is, the validity of statistical data also depends on the truth-values associated with the premises. The ability to model relations, no matter how sophisticated or complex, impose on variables constraints that include and exclude information (Musgrave, 2009, p. 205). This is why Hume (1988) called the positing of causes nothing more than a belief coming from convention and habit.

The problems of determining a causal relationship between germs and illness using statistical models contribute to my strong constructivist view that the decisions about what counts as a scientific explanation are bound to the discursive activity of social environments. Woolgar (1988), for instance, examines the processes of formulating hypotheses when the researcher must draw his or her notions of causality from the context of his or her social-scientific environment. Similarly, Polanyi (1958, 1966) and subsequently Henry (2006) argue that the norms and beliefs already circulating throughout society act as the "tacit" preconditions for the context of scientific discoveries that subsequently become the axiomatic presupposition(s) of scientific theorising. Fleck (1979), Irwin and Wynne (2003), Latour (1987),

Latour and Woolgar (1986), and Woolgar (1988) are all variously engaged in examining scientific practices as a way to demonstrate how social contexts contribute to the production of stable scientific representations that are epistemologically suspicious. Mulkay (2005) reminds his readers that there is a persistent view of science where scientific theories can neither establish "their validity nor their privileged epistemological statues" (p. 109) and that the knowledge claims produced under those conditions, therefore, are context-dependent and subject to the "varying interests, purposes, conventions and criteria of adequacy, in different social contexts" (p.109).

These epistemological uncertainties often result in contradictory and inconclusive conclusions from study to study (Ioannidis, 2005). According to Shrum (2000), what often makes claims and practices "scientific" is their association with scientific ideas and institutions (p. 101) (also see Aronson, 1984). Christley et al (2013) continue to discuss in their article the problems institutionalised science has in modelling infectious diseases with precision and then looks at how that uncertainty manifests differently in different reporting contexts. They conclude there is an institutional problem in the way science deals with the uncertainty inherent in modelling infectious disease. While these problems are acknowledged, institutional actors justify their use of these models by claiming the models may be wrong but they are useful. This refrain is often used as a tactic for sidestepping serious critique from non-scientific actors or groups.

This epistemological uncertainty and the privileging of context-dependent explanations is a source for uncertainty and distrust in scientific activity that provides the backdrop for my analyses in the first two papers. Within the context of this project, those "tacit" social conditions that intersect with the processes of scientific theorising and practice may create the conditions that either act as potential sites of contestation or as sites that potentially produce and reproduce

the metanarrative. This only reinforces Duster's view (2006) that a critique of the categories and premises has an important role as one of the self-correcting processes within science. These conceptual and methodological problems generate discourses that circulate within discursive formations. For my analysis, this means science is already a political (not in the pejorative sense) activity requiring the judgements of scientists working in complex social environments to privilege particular kinds of explanations. The recognition of these epistemological limitations serves as my axiomatic orientation to science and they are implicit in my analyses across all three papers.

The second research question, about how milk has been constituted and contested as a dangerous food, can be examined only in relation to the first question, and it presumes our interactions with milk are configured socially and involve the contributions of science. Therefore, it becomes a question of what were the important moments in the history of milk that gave rise to the beliefs we have about milk today. The idea that all milk should be pasteurised, homogenised, and fortified is now widely accepted as the norm by all but a few activists and other members of the public who actively seek to consume unpasteurised milk because they believe it to be a healthier choice. In opposition, governments have worked over the decades to foster belief in the necessity and inevitability of pasteurisation by subjugating the histories of contradictions and conflicts that arose at a time of crises and by continuing to resist the legalisation of unpasteurised milk whenever court challenges arise.

The Canadian government states that the implementation of pasteurisation laws at the beginning of the 20th century dramatically reduced the incident rates of illness from drinking infected milk (Health Canada, 1993). "Pasteurisation as necessary" for the sake of the public's health and safety has become the accepted mode of thinking used to determine our interactions

with milk (Czaplicki, 2007) (S. Jones, 2004) (Olmstead & Rhode, 2004) (Ostry, 2006) (Ostry, Dubois, & Nathoo, 2006). As a result, milk has generally moved out of the public's consciousness as an object of concern. Methodologically, it means the genealogist "must decompose the great certainties" through which the current beliefs about milk were constituted (Rose, 1994, p. 50). This involves an analysis of how these views emerged and were transformed and reproduced through time. It means identifying those moments that changed the direction of events and pushed other alternative historical trajectories into the background. It is about examining how interests imprint themselves on milk.

These two research questions come together around two central discourses: that of *nutritional equivalency* and the *issue of safety*. These are the primary discourses that coordinate the debate between pro- and anti-pasteurisation forces. When observing the debate between the propasteurisation state and the anti-pasteurisation activist, the demand for legal access to certified raw milk hinges on demonstrating raw milk is nutritionally superior to pasteurised milk and that the metanarrative overstates the dangers it attributes to unpasteurised milk. Unless activists can demonstrate that unpasteurised milk is nutritionally superior to pasteurised milk and that it is just as safe as or safer than pasteurised milk, the activist does not have much reason to pursue the legal right to have access to unpasteurised.

The first discursive issue is *nutritional equivalency*. This is the idea that the nutritional differences between pasteurised and unpasteurised milk are insignificant and in no way lessen milk as a valuable food that contributes to human health. Government policy reflects a reductionist view of nutrition where the value of a food is determined by the presence and amounts of its constituent parts (Hoffmann, 2003). In this model, milk is reduced to a liquid medium carrying those vitamins and minerals said to be the necessary building blocks of health.

In contrast, activists argue there is more to nutritional health than simply consuming vitamins and minerals in their isolated, elemental forms. Activists take a more holistic view of food where enzymes, haemoglobins, proteins, fats, minerals and vitamins, all which are destroyed, damaged, and/or altered during the pasteurisation process, are also viewed as essential contributors to health. In the activist's view, the nutritive components of milk work synergistically. The loss of some of those components lessens the bioavailability of other nutritive properties, thus reducing the full health benefits historically attributed to drinking milk (Douglass, 2007) (Howell, 1985) (McAffee, 2007) (McDougall, 2003) (Planck, 2006) (Pottenger, 1995) (Schmid, 2003). Nutritional equivalency is very much an issue about how to articulate nutritional values and make claims about the health benefits of milk. Reducing milk to its nutritional components has been the dominant mode of thinking because it presumes a strong causal claim between diet and health (Hoffmann, 2003), which in turn validates policy and prescribes how the dairy industry produces and distributes milk.

The second discourse organises around the *issue of safety*. It comes out of the alignment between germ theory and pasteurisation technologies and involves developing ideas about what the acceptable thresholds of risk are for individuals drinking either pasteurised or unpasteurised milk. This is a normative issue of governance, rather than a technical analysis of the mechanisms of policy development or an examination of a chronology of events. A normative understanding of risk becomes essential for understanding how the relationship between milk, germ theory, and the efficacy of pasteurisation technologies lead to medical and political intervention. For governments, the evaluation of risk in terms of protecting the public from illness becomes a recursive operation reassessing an ever-present threat from milk on the assumption that risk is evenly distributed throughout the entire population. As a potentially dangerous disease-bearing

substance, milk becomes a threat to public safety, which demands the continual management of risk (Petersen & Wilkinson, 2008). In the early decades of the 20th century, methods of assessment and pasteurisation technologies were not standardised or widely available and were often ineffective (Jenkins, 1926; Holsinger, 1997; Savage, 1933). In recent times, medical practitioners have begun to better understand that illnesses surface in patients who already have other immune suppressing illnesses (N. Johnson, 2008, April; Thoen & LoBue, 2007). Nevertheless, assessments of risk are now technical issues oriented toward avoiding exposure to disease-causing pathogens. Scientists and policymakers agree that the risks of becoming ill from drinking unpasteurised milk far outweigh any conceivable loss of health benefits from slightly decreased levels of some vitamins and minerals affected by the process of pasteurisation. Policymakers and researchers work toward eliminating the threat from pathogens in ways that least affect the taste and texture and do not further alter the levels of those vitamins and minerals deemed essential for health.

**Theory and Methodology**

The overall arc of this project is genealogical. The first two papers directly employ genealogical method, while the third paper contributes to the genealogical arc of the project by employing a form of discourse analysis on some of the current debates surrounding milk. In this third paper, I use Deleuze and Guattari's distinction between royal and nomadic science found in their nomadology (1987, pp. 351-423) and a version of discourse analysis informed by Foucualt (1989) and Luke (2002) as conceptual tools that facilitate my investigation of those current debates. How I use those analytical tools will be explained shortly. Generally, the goal of this project is to use a genealogical approach to make the believers in this metanarrative surrounding milk "decidedly uncomfortable" about their positions (Kendall & Wickham, 1999, p. 29). In that effort, I make no attempt to use genealogy as an alternative systematic approach that introduces

yet another metanarrative. This would only invite similar critiques. Rather, my goal is to dissemble and expose some of the points of contestation that contribute to the legitimacy of the metanarrative.

**Foucault: Genealogy, power, and biopolitics**

I employ a genealogical perspective to examine the various histories and rationalities that have contributed to the perception that all milk needs to be compulsorily pasteurised. A genealogy allows me to examine select moments of discursivity in the history of milk, particularly those moments when the acceptance of germ theory broke with other ideas about the "causes" of disease formation, and what these discontinuities meant for configuring milk. Genealogies reveal not only the limits of what people think is possible but also reveal what spaces are still available in which change is still possible. The genealogist does not seek to contribute to a new telling of events. Rather, he or she deconstructs those accepted moments taken-up as the "official" version of events to show that they also had their origins somewhere else, in some other context, mode of thought, or set of events (Foucault, 1984, pp. 80-81). It is about uncovering and problematizing the conditions of possibility that make knowledge claims possible and actionable (Kendall & Wickham, 1999, p. 37). I use this genealogical approach to shift the focus from accepted historical and philosophical assumptions and bodies of knowledge to an exposition of the problems of how medical discourses were struggling to constitute the relations of life through uncertain processes in a social environment that was also full of uncertainty.

Within this uncertainty, power operates to inscribe medical realities on to milk that make it decipherable and subject it to regulation and surveillance. This is Armstrong's *New Surveillance Medicine* where healthy bodies get remapped by comparing the individual's medical condition

with the potential risks that the entire population has in becoming ill. The line between health and illness gets blurred (Armstrong, 1995). Likewise, milk seen through the lens of germ theory and nutritional science is mapped on to individuals and forecloses on the range of possible individual behaviours. Raw milk is normalised as dangerous because it threatens some of the population some of the time. Expertise is no longer just about knowledge, rather it is about relations of power because of the inability to accurately diagnose individuals (Fox, 1994, pp. 27-29). Channelling experience through germ theory also becomes a relation of power because the theory cannot unerringly decipher our relationships to milk through observing cases. A relation of power is maintained by imagining the thresholds of risk to the entire population. Rose adds that this can only be accomplished through statistical formulations and it becomes "the mechanism for conferring legitimacy" on governments and the institutions through which governments operate (Fox, 1999, p. 197ff.). A new governable "normal" emerges where unpasteurised milk may confer nutritional health but remains a permanent risk factor for illness because, statistically, some people become sick some of the time. A genealogical analysis reminds readers of the discursive spaces submerged within the metanarrative and reopens those spaces to make them "capable of opposition and of struggle against the coercion of a theoretical, unitary, formal and scientific discourse" (Foucault, 1980, p. 85). Genealogy reveals where, when, and how these nexuses between relations of power and knowledge can been seen operating.

To understand the impact these relations of power have on milk, the genealogist examines how and what effects of power are made visible via the discourses circulating at those moments in time. For Foucault, power precedes material production: meaning knowledge and expertise are achieved through relations of power that pre-exist subjects, institutions and circumstance. At the

same time, what constitutes knowledge can only be determined and correctly "read" by individual experts operating within existing regimes (Fox, 1994, p. 29). Knowledge and power have a common genesis that structures knowledge regimes and creates the conditions for producing legitimate and illegitimate knowledges. What has become accepted by experts is a consequence of what has been made visible through other discursive efforts, scientific or otherwise. I want to problematize these issues by using examples that suggest knowledge claims are always socially produced phenomenon bound-up in power configurations (Foucault, 1980) (Nietzsche, 1976, p. 46). However, analyses of these relations of power are "never localized here or there, never in anybody's hands, never appropriated as a commodity or piece of wealth. Power is employed and exercised through a net-like organization" (Foucault, 1980, p. 98). It circulates.

While Foucault and Latour have similar views that knowledge is socially constructed and I am using the work of Latour and STS as a point of departure, there are differences in my approach to studying these constructivist phenomena that are worth acknowledging. Latour's *Actor Network Theory* (ANT), as described by Murdock, Marsdens and Banks (2000), differs from a Foucauldian-type analysis of relations of power. ANT attempts to "deconstruct" how power is operating by examining the particulars of the myriad of relationships that sustain the power of the powerful (p. 113). Accordingly, ANT seeks to demonstrate how networks are established and held together through various alliances, associations, interrelations between actors, and actors within heterogeneous networks.

Relations of power in ANT become about analysing what is happening. According to Goodman (1999) this approach is best because it avoids becoming entangled in discussions that involve creating and using unreflexive categories such as culture versus nature. He sees ANT as form of analyses capable of dissolving any need to refer to or undertake an analysis of binary

oppositions. He sees binaries as a problem in two respects. First, binaries limit analyses to examining the *a priori* statuses of those categories. Second, they limit subsequent descriptions and explanations of social relations to the constraints of those categories. Goodman points out that ANT can avoid these circumstances by analysing the relations between agents within complex networks of interactions. It is the analysis of specific actors within networks that "differ in size, scope, and power, but all obey the common principle of symmetry, that is, of being co-productions of nature and society" (p. 25) that matter in these types of analyses. Goodman's goal is to avoid analyses of binary oppositions and examine what has happened and/or what is happening to reveal the particular alliances and struggles that shape relations within and across networks.

Alternatively, relations of power in Foucault are analysed as a strategy for thinking (Bãlan, 2010). Foucault is interested in how relations of power circulate through institutions to discipline subjects. Institutions are manifestations of relations of power and use that power to exercise control over subjects. However, power can no longer be analysed only in negative terms. That is, as a form of disciplinary power used to dominate subjects. Power is also productive. It produces reality through discourses that circulate as a way of thinking that imposes order on a set of events (Foucault, 1977, p. 194). Therefore, in analysing the productive mechanisms of power "we must investigate the conditions of their emergence and operation" (Foucault, 1990, p. 73). It is the defining, categorising, and assembling of systems of classification that organise the institutional form and that, once normalised, order how thinking occurs, what can be thought about, and who is allowed to act.

In contrast to ANT, Foucault sees power circulating through binaries. The deployment of binaries imparts meaning and establishes categorical distinctions that are used by state actors to

describe and order the world as a disciplinary technique that cannot be ignored. When milk is limited to the categories of pasteurised and unpasteurised, it is useful to examine how those kinds of conceptualisations are used to negate opposition. The effect of this type of language as a disciplinary technology is to constrain discursive activity and normalise particular points of view. While ANT focuses its analysis on the linkages between agents within and across networks, it does not focus on the conditions that lead actors to act and think in the ways they do or examine the ideational conditions that give rise to existing sets of relations. The genealogist chooses those instances that expose the complex processes of ordering and that cannot be subordinated to some authorised narrative. Following Koopman (2013), I use genealogical method for problematizing claims and circumstance. Therefore, I sought those moments when contested ideas supplanted one another and reconfigured the conditions for thinking in the present. These moments provide instances of how discursivity contributes to the solidification and valorisation of particular ways of institutional thinking.

Foucault (1980) suggests there are two types of mechanisms through which power circulates: (1) as an effect of coercive state apparatuses (particularly the legal system) and (2) as the disciplinary forces of coercive forms (p. 107). These mechanisms of power are not reducible to one another; rather they operate simultaneously as a disciplinary technique and as a coercive normalizing of the privileged discourses of experts (pp. 96-103). Knowledge claims are produced in these environments. Science is a coercive mechanism disciplining raw milk activists and often hiding the coercive forms of power by normalising its own "ideas as practices" (p. 107). Normalised knowledge claims hide the disciplinary tactics of power. These claims hide the struggles and contradictions that persist under the surface, thus making metanarratives of progress, continuity, objectivity, and neutrality possible.

Foucault's emphasis is on how subjects are the target of disciplinary techniques and technologies operating across and within regimes of power/knowledge. Therefore, when analysing relations of power, one should begin at the edges of the regime where the power/knowledge regime has yet to overtake those alternative points of view. It is in those contested moments that "epistemological acts" are committed that come to shape the new truth regime (Foucault, 1989, p. 4). This is the case for looking at some of the different moments that contribute to the formation of the metanarrative. Therefore, the genealogist orients his or her analysis by starting with raw milk activists in the present to understand how they are still subject to, yet rejecting, the pressures of the existing knowledge regimes and state apparatuses that govern milk. It is at these sites where the processes of codification, classification, and categorisation are most obvious. It is in these circumstances that critiques may insert themselves—at those points where power is exercised, where it becomes constitutive, and where it will have consequences on future understanding (Foucault, 1980, p. 97).

This does not preclude an examination of how ideas have become solidified within institutional forms and used to disciple marginalised ideas. According to Jessop (2008), these analyses include an examination of how discursive relations of power have instantiated themselves within institutionalised forms. These types of analysis "begin from below, in the heterogeneous and dispersed micro-physics of power, explore specific forms of its exercise in different institutional sites, and consider how, if at all, these were articulated to produce broader and more persistent societal configurations" (p. 148). The study of relations of power examines instances of contestation that have led to the subjugation of alternative views by investigating how ideas and intentions are circulating as discourses through institutions. In addition, it examines how those ideas and intentions come to be "colonized and articulated" (p. 148) in

various forms, including institutional forms, that become codified as forms of domination. Jessop's approach—that there is a relationship between ideas, the formation of institutions, and the exercise of state power—reflects the general aim of my dissertation. However, it is not my empirical focus to examine how medical institutions came into being or identify and analyse the ways in which specific mechanisms of state power have been exercised. For me, Jessop's analysis affirms that relations of power are not localised in state institutions. State apparatuses are centres of power but they are always precariously situated as they are subjected to the constant pressures from changing discourses.

Ideas about germs, nutrition, milk, and illness produced and continue to produce particular kinds of institutional responses that simultaneously valorise science and affirm state authority by depoliticising public debate using science. Therefore, it is important that analyses of state apparatuses begin by problematizing how state forms are constituted as an effect of knowledges, political strategies, and relations of power (Lemke, 2012, p. 25-31). Those constituting processes follow a pattern. The work of DiMaggio and Powell (1983) illustrates how bureaucratic state apparatuses become "locked-in" to patterns of belief and behaviour that are in turn reproduced in other bureaucracies. That is, bureaucracies reproduce themselves within an existing homogenous "organisational field" (DiMaggio and Powell, 1983). This reproduction is largely being driven by state need and the professions that staff them. These bureaucratic institutions use the knowledge produced within the university system to legitimize these state apparatuses (p. 147). Subsequently, these state apparatuses have become more homogenous in their assessments and responses to public need (Jones & Davidson, 2014). This means ideas and practices around milk are constrained by the organisational field that reifies a particular metanarrative about human relations to milk. This understanding of institutions as a solidified node for domination (the royal

science I refer to in the next section) sets the stage for better understanding the content and context of the struggle between the propasteurisers and raw milk activists of today. For me, I have refrained from detouring into an examination of the specific mechanisms of dominance as I prefer to examine how ideas and intentions become an organisational force that cement sets of relations including institutional forms. This is what productive power does. The goal of this type of analysis is to examine some of the discursive activity through which knowledge emerges. This means examining how past events have established historical precedencies that establish the conditions through which institutions operate and how the current institutionalised claims of propasteurisers are operating to dismiss the concerns of activists.

Activists give voice to marginalised knowledges and resist these homogenising, institutionalised knowledge regimes that are sustained by state-corporate-medical interests justified using science. I adopt this method not to create yet another unified body of knowledge, but to provide a number of genealogical instances that "reactivate" marginalised knowledges and practices as legitimate challenges to the privileged ideas of the current ideational regime (Foucault, 1980, pp. 83-85). The adherence by activists to contested knowledges becomes the basis for biopolitical action. The goal of state actors is to have institutionalised knowledges become widely accepted by the public. Subsequently, governments try to manage large populations by trading on the public's fear of becoming ill or losing access to state resources. This biopolitical strategy is used by governments to encourage individuals to regulate their behaviours in ways that are aligned with state policies.

This type of biopolitics is implicit and explicit throughout my project. It is a way of governing populations to make life and the daily events of life part of the field of power. It moves beyond the Weberian notion of power that domination and subordination is exercised

through institutions and beyond Marx's view that power operates as a form of exploitation organised through a capitalist mode of production. In both cases, power is relational, but conceived of as something external and used to exercise control over others. Biopolitical efforts to control the health of populations means controlling not only the behaviour of individuals through the impositional structures of the state, but in also "educating" populations to believe that the ways in which they understand their world is sympathetically aligned with state interests. This alignment between state and individual emerges when each individual believes the state is acting on their behalf and that the state mirrors the beliefs of the population. Disciplining raw milk activist using science as an educational tool is consistent with the imposition of the preventative healthcare paradigms discussed more thoroughly in my third paper.

One way to manage populations using a biopolitical strategy is to organise and reify public debates through sets of mutually exclusive oppositions—rational versus irrational, scientific versus unscientific, pasteurised versus unpasteurised, legal versus illegal, and individual choice versus public safety. This reduction of the debate to simple oppositions is a practice of the hegemon as a way to order the world and represent it as given and incontestable rather than as "mobile and transitory points of resistance, producing cleavages in society" (Foucault, 1990, pp. 83, 96). Reducing the complexity of experience to simplified binaries gives the propasteuriser an advantage. By framing the debate about the dangers of drinking unpasteurised milk as one of science versus consumer choice; institutionalised science, governments, and industry can avoid criticism under the guise of scientific necessity.

*Statements, discourse, and discursivity*

Social life is ordered through discourses; therefore, discourse analyses are primarily concerned with how power is exercised through language and practices. Discursive activity is

how discourses come into being and are contested. Foucault uses discourses in two ways (O'Farrel, 2005). First, discourses are a "way of speaking" and, secondly, discourses informing a single body of knowledge also represent a single discourse (p. 78). For example, there are discourses within science and science as a body of knowledge is also a singular type of discourse. In both senses, discourses act as structuring forces that structure speech, thought, and practices operating within and across discursive fields. These fields subsequently establish the conditions that produce and transform the categories and rules through which bodies of knowledge emerge (Foucault, 1989). Accordingly, Kendall and Wickham (1999) suggest that discourse analysis is always carried out when examining texts in relation to other texts such as books, scholarly articles, newspapers, government documents, as well as formal and informal discussions. The analyst, in their view, must use the texts produced by discourses as a way to understand how discourses are contributing to and ordering domains of thought and subsequent practices (p. 38). However, the statements and/or texts that contribute to discourses and discursive fields are not synonymous with them (p. 39). Subsequently, the analysis of how statements organise discourses is an essential aspect of analysis in Foucault's work (p. 42). However, that analysis is always contextualised within the broader context of social life.

Discourse analysis is about both an analysis of how statements are produced and an analysis of the particular function statements have in configuring discourses within an historical-social context (Foucault, 1989, pp. 90-98). The ordering of discourses within discursive formations reflects attempts to control the presentation of and the interpretative processes of information. Therein, they are already reflecting relations of power. Discourses and the statements that compose them have the power to transform, decompose, and reproduce beliefs. A discourse "circulates, is used, disappears, allows or prevents the realization of a desire, serves or

resists various interests, participates in challenge and struggle, and becomes a theme of appropriation or rivalry" (p. 118). Discourses as relations of power are omnipresent as well as productive and repressive. This type of analyses does not necessarily confine itself to textual analyses, it can also be used to examine how texts can bring about political-social change. Discourses, then, may be used to examine how the macro social-political contexts of society are ordered through the discursive activities of actors. That is how I want to focus my discourse analysis.

I am using Foucault's discourse analysis to examine how discourses reproduce and/or reinforce the metanarrative, which is akin to a knowledge regime. In Luke's view (2002), discourse analysis can and should focus more on how texts are deployed on the meso and macro levels to constitute and organise social and political environments. He is reacting to the tendency in Critical Discourse Analysis to focus on the close, microanalyses of texts. Instead, Luke wants to shift the emphasis from a discourse analysis focused on close, textual analyses to an analysis of how discourses are shaping the macropolitics of everyday life. He argues that analyses of discourses should move beyond the traditional focuses and methods that primarily analyse texts to an examination of how those texts are used as a productive force that can transform bodies of knowledge and relations of power in social and political environments (p. 106). For him, discourse analysis must also include a critical analysis of the "visible practices" that are a consequence of deploying texts (p. 102). Therefore, analyses of discourses should also emphasise what these texts "do" to solidify and transform social and political conditions and points of view (p. 102). I use this discourse analysis in the third paper. There, I examine some of the statements/texts used by propastuerising state actors and raw milk activists as a way to focus on how the discourses of nutrition and safety are configured differently according to interests of

these different sets of actors. I further examine how each side is contesting the other by employing, interpreting, and producing different texts in their efforts to achieve discursive dominance.

These discursive encounters between propasteurisers and activists are not merely self-referential conversations reducible to language. Discourses circulating within a discursive formation always come up against non-discursive realities (Mills, 2003, pp. 55-56). Thus, it is a non-discursive "fact" that some people have become ill after drinking milk, that milk contains bacteria, that germs and illnesses present themselves as correlates in diseased persons, that some people drink unpasteurised milk with no ill effect, that germs are ubiquitous in the environment, and more. However, these "facts" and the relationships between them cannot rely on claims that science has access to a concept-independent reality outside discourses. To make that distinction presumes that, at some level, an observer has some ontological insight into the "real" essences of the material world.

Philosopher Ian Hacking (2000) uses germs as a specific example to think about the relationship between the discursive and non-discursive realms. Hacking calls germs an "indifferent kind" (p. 104). That is, germs do not interact with human notions of germs as pathogens (pp. 104-106). What happens between the germ and the patient "is entirely independent of my correct or incorrect description" of what the germ is doing or what is happening to the patient (Hacking, 2002, p. 108). It is a non-discursive reality to say that germs exist and act independently of how we classify them. A germ, Hacking writes, will continue to do what it has always done, quite apart from our "discovery" of them (pp. 104-105). However, the role they play in human interactions is defined socially, not by any *a priori* insight into the essences of germs, but by its relationships to its environment including its associations with

people. This is why Foucault insists our understanding of the non-discursive still depends on some interpretative process, like creating scientific and statistical accounts as a way to order our discourses about what makes milk dangerous.

The disagreement between the strong constructionist position and the naïve realist and weak constructivist positions is that the latter view hazards as given and see risk as a response (Lupton, 2013b, chapter 2). In each of their cases, hazards are given and human understandings of risk are determined in relation to hazards. This dichotomises the world and puts hazards in some sort of non-discursive, context-independent realm. Risk then becomes part of the discursive, social realm whereas scientific "discourses" arise in response to the "real" world. While Foucault acknowledges the discursive and non-discursive, the non-discursive is not beyond or outside discourse. The point for Foucault was not to find and set the boundaries between the discursive and non-discursive. Where the line between the two could or should be drawn would be terribly problematic (Woolgar, 1988). Kendall and Wickham (1999) also see this as problematic. They argue that Foucault's understanding of the non-discursive is not only inseparable from the discursive activity of discourses, but that human understanding of the non-discursive is subordinate to discourse. This view of the relationship between the discursive and non-discursive parallels the strong constructivist view held by Fox (1998) and described by Lupton (2013b, p. 43-49), and outlined earlier in this Introduction as my orienting view. Kendall and Wickham's (1999) reading of Latour in his book *Science in Action*, pages 94-100 reflects a strong constructivist position. In it, Latour argues that "facts" are a product of discourse and that we use our experience of nature to justify our acceptance of facts. Yet, those facts can never be proven by appeals to nature apart from discourse. Neither Latour nor Hacking are trying to demonstrate that there is nothing outside language and discourse. Rather there is no logical

possibility for having insight into nature except through discourse (p. 40). This is why relations of power matter. They are productive forces in the production of knowledge. At some point, relations of power must produce "truth", which can then operate as the truthful narratives that society needs to order society and allow it to function (Foucault, 1980, p. 93). Given that necessity, it was much more important for the Foucauldian to examine how relations of power and knowledge claims were crystallised and deployed in the consolidation of truth regimes (Han, 1998, p. 76). For instance, germs and people exist in complex environments where there are questions about how germ theory contributed to the rise of the metanarrative—a truth regime—and it is this discursive activity formed around milk that I have problematized in my papers.

**Nomadology within the Genealogical Arc**

One way to think about how the propasteurising state and raw milk activists advance their ideas about the nutritional value and safety of raw milk is to appropriate Deleuze and Guattari's notions of royal and nomadic science found in their nomadology (1987, pp. 351-423). I use those concepts as representative of heterogeneous discursive entities that circulate competing discourses about the nutritional value and safety of raw and pasteurised milks using the common language of science. In keeping with Jessop's view, I view royal and nomadic science as discursive sites that produce "persistent societal configurations" (Jessop, 2008, p. 148) that are useful for analytical purposes. Nomadology is a treatise elaborating how resistance to state power is organised through individual nomads, in this case raw milk activists, who resist the coercive state strategies of appropriation and consolidation. The distinction between the royal and nomadic science allows me to think about how health, nutrition, and safety are being constituted differently within and between those two fields.

Deleuze and Guattari (1987) use the concept of royal science to denote bureaucratic, institutionalised systems of expertise that operate as a part of the centralising, routinizing, standardising hierarchal apparatuses of government. The nomad, alternatively, operates outside state control and wants to avoid state interference. However, whenever the state tries to control the nomad, the nomad goes to war with state's efforts to control the nomad's existence. The work of the state is to retain the apparatuses of power by appropriating its opposition, namely the nomad. Royal science is an apparatus of the state that functions as a bureaucratic, institutionalised system of expertise working to centralise, routinize, and standardise life on behalf of a government. Conversely, the work of nomadic science is to wage war against the state—always acting as an agent of metamorphosis (pp. 357-359). The division of labour between royal and nomadic science is akin to governors versus the governed or form versus content where the state provides the forms necessary to interpret the content of life (p. 369). The contrast between the two is instructive because royal science is the search for universal laws where the variables are fixed, whereas nomadic science challenges the fixity of the laws. They question the regularity and standardisation of the variables and the presumed relations between them by asserting the instability and reordering of the dominant royal science (p. 369-371). Royal and nomad science do not appeal to or produce different kinds of science; it is their modes of formalisation that are different. Royal science coordinates its activities with other state actors through its policy and regulatory mechanisms. On the recommendation of scientists and in coordination with the scientific consensus, the state creates an ideational and regulatory environment that tries to limit what issues come before it by scrutinising problems through a specific set of institutionalised theoretical lenses (pp. 362, 367). Royal science represents state interests: "State science retains of nomad science only what it can appropriate; it turns the rest

into a set of strictly limited formulas without any real scientific status, or else simply represses and bans it" (p. 362). In contrast, nomadic scientists are those raw milk activists working to reconfigure the claims of royal science. I have mapped this division of labour between royal and nomad onto the divisions between the propasteurising state and the activist-nomad to draw out how the deployment of science by either side is different and serves different interests. This relationship between the royal and nomadic reflects tension between institutionalised discourses and the marginalisation of non-scientific actors that are subject to the claims and risks coming from those institutional policies.

While I examine how discourses are circulating, these tensions between institutions and members of the public have been examined more closely in the work done by Jones and Irwin (2010). They examine the possibilities and difficulties of incorporating lay members of the public into policy discussions, and find at best that the result of those efforts, at least in a British context, have been ambiguous. It remains difficult to integrate the public into the existing institutional processes. Similarly, Wynne (2003) discusses at length how institutional science excludes public input by positioning itself as having special epistemological insight that tends to exclude non-scientific views that are not aligned with the institutional view. According to Wynne, the problem here is not with the public questioning scientific claims but with science unreflexively claiming to have special epistemological insight that it then uses to dismiss non-scientific views. In the third paper, this kind of unreflexive encounter between the royal and nomad is examined using discourse analysis to reveal how each side speaks to the other through different conceptual and social lenses.

**Method**

Genealogy as method is a technique for problematizing the challenges that arise within the histories of systems of thought. Genealogy as a form of critique that problematizes issues is a way to make apparent the contingency and complexity of social circumstances (Koopman, 2013, pp. 18-19). It is a technique for decomposing truth regimes by critiquing the modes of thinking and the concepts used to make claims. Methodologically, genealogy is the work of collecting the applicable information from the collective archives of society. The archive is used to elucidate points of friction that disturb the metanarrative (Foucault, 1989, p. 147). In the case of milk, that means problematizing the ideas and practices that contribute to our understanding of milk as dangerous. Mills (2003) makes several methodological recommendations to examine these processes that I attempt to follow when it comes to *doing* genealogy. She suggests the following six tactics: (1) use archival material, (2) be sceptical, (3) don't make second order judgements, (4) look for contingencies rather than causes, (5) investigate problems rather than a subject, and (6) don't use your findings to overgeneralise (pp. 110-116).

Scepticism must operate on all levels. No one way of doing and/or perceiving things is sacrosanct. More specifically, it is scepticism toward ideologies, metanarratives, organised belief systems, and the belief that causality can be modelled and/or studied in complex social systems. I think this includes a scepticism toward scientific ways of doing and perceiving relations that "rejects the use of science to predict and to make policy decisions…[and]…oppose[s] those who use positivist science to reinforce power relations and bureaucratic forms of control over people" (Neuman, 2000, p. 84). In this project, I am sceptical about the valorisation of particular sets of claims that organise our interactions with milk. I make my best efforts to suspend judgement about whether pasteurising milk is necessary or not, although I do not pretend to have done this

entirely. Embarking on this project implicitly implies I have sympathies with one side or another and my position influences what texts matter in the research process. However, as Mills points out, while an ideal analysis would make no judgements about content and only provide numerous examples of those points of contestation where power operates, this level of objectivity is not possible and may be undesirable as any analytical task has within it some political intentions that make an analysis of those relations of power worth presenting. Therefore, while I do not drink milk, my sympathies are with the activist's right to choose and have government administer that choice.

Genealogy is a process of *bricolage* that uses a variety of sources to destabilise the metanarrative by contextualising the circumstances through which it was produced and then using the "bits and pieces" found to suggest there are problems with the existing view (2000, p. 147). Therefore, I did not attempt to trace causes or prove a case. Rather, I pointed to a few of those moments of bifurcation and contestation that could have channelled historical events in a different direction. I did this by referring to and having knowledge of other "source material" (Foucault, 1984, pp. 76-77). By reading and gathering different points of view, I began to see the metanarrative as problematic. In the work of Foucault, I found ways to analyse problems arising from the metanarrative. He suggested the way to examine a problem or set of problems is by gathering countervailing examples as a technique to undermine ideas that have been used in the constitution of knowledge regimes and that purport to demonstrate the "truth" of our historical circumstances (1984, p. 80). This started out as an arbitrary process of reading the statements made by raw milk activists and the analyses done by journalists working for magazines and/or bloggers and journalists publishing online. I quickly moved to reading published books, websites, and the online blogs of activists to understand further why they believe drinking raw

milk has value. As I read those texts, I searched for other more academic texts that could either support or challenge their points of view. It became apparent that much of what is contested between raw milk activists and propasteurising state is connected to historical claims and events. This began a process of gathering historical evidence to understand what was being contested and why.

The processes for evaluating and selecting the relevant historical evidence was not always obvious. Given the sheer volume of historical material, the process was full of difficulties and was mostly a process of reading until I found the types of evidence I needed to understand and problematize the metanarrative. Neuman (2000) raises questions about what counts as legitimate evidence when examining historical circumstances. He suggests that there are no easy answers or universally accepted criteria: evidence that was not relevant at some point may become relevant and evidence once regarded as important become irrelevant. It depends on the context. He briefly outlines three general criteria for evaluating what evidence should count. First, the evidence must fit with the relevant analytical framework. Second there must be sufficient detail. Third there must be some general agreement about the facts. When properly applied by the researcher, he or she will be able to assess the value of the evidence (p. 394). It is, of course, the relationship between the analytical framework and evidence that contributes most to the problem of how to evaluate evidence for the (re)telling of histories.

Historian Keith Windschuttle (1996) contends that postmodern and post-structural analytical frameworks have all but destroyed our capacity to demonstrate competence in theorising and research, or to "know" anything historical. In contrast historian Hayden White (1973), in his book *Metahistory*, argues there is no possibility for objectivity and/or knowing. There is only the potential for constituting meaning and social identities; therefore, the value of

evidence is relative to the context being studied. What counts as the most important evidence in any given analysis is how well it can be organised according to a particular conceptual framework. There is always slippage between the researcher's perspective and data gathering. This is why genealogy matters. It gathers evidence and avoids making judgements about how those constitutive moments of bifurcation and contestation should be read except to show that the acceptance of the metanarrative was problematic and that scientific theorising and practice contribute to those problems. It would be anathema for Foucault to retell what is already accepted. Instead, it is the seemingly uninteresting ideas and events that signal important shifts in the modes of thought and belief that matter. Ultimately, genealogies are just another form of analysis posited in a specific moment of time meant to divert, if only for a moment, our attention away from the over-coded metanarrative surrounding milk that decontextualizes life.

My analysis in the first two papers relies on a range of archival materials, including peer-reviewed articles found in scholarly journals, historical monographs written by historians and biographers, government documents and reports, as well as magazine and newspaper articles. Each of which provide(s) the content and context for my analysis and act as points of departure for that analysis. This practice follows Foucault. In *Discipline and Punish*, Foucault starts with a historian's account of Damien's execution and the commentary of others. This led him into a discussion of executions as a means of understanding judiciary power that constitutes individual relationships to state power in particular ways. *Madness and Civilization* similarly uses historical accounts from historians as a way to enter a discussion about how madness is constituted in different historical moments under different kinds of relations of power. I am attempting something similar. Medical science and its reconfiguring of milk as dangerous is presented by

historians and scholars as arising from a continuous series of improvements in knowledge leading to the need to pasteurize milk.

A big part of that debate is carried out in hindsight by those same historians and scholars who are working within particular domains of thought that impose on history a particular interpretation of claims and events. These claims and events contribute to an objective body of knowledge, but they are in actuality contested and contradictory. Therefore, I sought in texts those narratives, stories, and events that are often present but glossed over. Most analyses of milk, even in their depth and complexity, have within them the thread of progress and inevitability. These threads run through these texts like sequences of conquest moving from the unknown to the known, the chaotic to the ordered, the simple to the complex, and so on. Thus, it was in those textual landscapes that I looked for points of contestation that were representative of the kinds of contingencies that feed a genealogical analysis. For instance, in the first paper there are obvious points of contestation: the friction between Pasteur and Bechamp, as well as marginalised acts of resistance like those carried out by Metchnikow and von Pettenkofer in their efforts to disprove Koch's germ theory. Although they appear in some historical retellings, not much is made of them because the metanarrative that germ theory wins out ultimately makes those moments all but irrelevant. Yet, these are points of bifurcation where the dominant view inserts itself to create historical continuities.

How I have dealt with this apparent problem of using texts as primary sources that provide me with some of the historical content and context needed for my analysis while at the same time using those same texts for critique can be found in Part III of *The Archaeology of Knowledge* (1989). What matters is how those statements and texts are being used at different moments within the papers. It is a question of their "enunciative function". This means that my use of the

statements found in texts very much depends on the function those statements have in my analysis. I am not involved in a factual challenge of the texts; rather I am using the statements and events found in these texts and across texts to show how they are a challenge to the metanarrative. For clarity in my papers, I try to distinguish between these two uses. Whenever I indicate the authors of texts are speaking, they are usually providing some content or context. Alternatively, whenever I am using my own voice then I am typically engaged in analysis. This distinction cannot always be made as clearly as I would like. There are times when I use texts to provide some content and context and then immediately use that content as a point of contestation. Nevertheless, I have tried to avoid this situation as much as possible. In the end, while I rely on these texts, I do so critically and I always use them within the broader context of my genealogical project.

The third paper differs in approach from the first two. In it, DA to understand how the royal and nomadic sciences deploy discourses as political technologies to debate the nutritional differences, if any, between pasteurised and unpasteurised milks and whether one type of milk is safer than the other. Throughout the third paper, the texts written by activists and published in books, published online, or released as video documentaries are used as primary sources. I do not critique their claims. Rather, I use their claims to analyse how and what types of claims are being made by them in their engagement with the government. I use those texts to examine the points of contestation between propasteurisers and the activists, but I do not examine whether what they claim is true. The goal of this type of analysis is to contrast the statements made by activists with the propasteurising state to see how and why they disagree about the nutritional content of milk and the safety of drinking raw milk. The emphasis is on presenting the activists point of view. While I use some primary accounts for representing the state's position, such as statements made

in newspapers, magazines, or in government documents, most of my understanding of what matters in this debate comes through activist arguments. I generally use scholarly articles, books, and some government documents as a way to set the stage for my analysis in that they provide me with the analytical concepts and frameworks for contextualising the debate.

**The Papers**

This section provides a brief overview and description of what I tried to accomplish in each of my papers. The first and second papers directly discuss some of the events and circumstances between 1840 and 1940 that contributed to the formation of the metanarrative. The analysis in the third paper looks at the current debate, which is a consequence of those circumstances. This was a transformational historical period in the history of milk, what Braudel (1980) and Wallerstein (2001) would identify as an historical *conjuncture*. Their idea is that different and often unrelated events, ideas, circumstance, and individual actions intersect in unpredictable ways. These convergences become the conditions through which individual actors and/or groups seek to resolve a crisis. These changes are not merely the consequence of improving the efficiency of some existing technologies and/or believing more deeply in the explanatory power of existing theories or concepts. Rather, they are identifiable only in hindsight when the consequences of those actions produce recognisably different modes of thought and interaction between actors and between actors and the material world. The emergence of germ theory, the nutritional sciences, and pasteurisation technologies are now seen as important changes in managing public health. Since that time, both Canada and the United States' Federal governments have adopted rather dogmatic policy positions with respect to the sale of certified raw milk.

The debate on how to resolve the variety of threats to public health in large industrialising urban centres was characterised by six issues: (1) the unresolved debate within the medical

community on how to best prevent milk from contamination, (2) a lack of technology, (3) debates within the scientific/medical community about contagious disease causes, (4) the prioritization of market-oriented agendas favouring dairy farmers and a newly emerging dairy industry, (5) the lack of institutional organisations and administrative oversight made policing the dairy industry at the time, and (6) competing and conflicting public debates championing the pasteurization of milk. The specific issues impacting the debate about milk safety were further characterised by: (a) risk aversion, (b) political expediency and avoidance of litigation, (c) cost-effectiveness, and (d) the emergence of germ theory as the dominant scientific model. All these issues intersect and are discussed to varying degrees in my papers. However, the primary focus is on how the discourses of nutrition and safety organised scientific thought and are being employed to constitute our interactions with milk. The research in my papers reveals that the conception of milk as nutritious and safe is shaped discursively and results in standardised narratives about milk that have been and remain contested and unstable.

**Paper One**

This first paper starts from the premise that naturalising milk as a dangerous food has its foundations in how well scientists were able to represent experience. How researchers theorised milk in relation to illness during the 19th century and early decades of the 20th century was what ultimately organised the public's interactions with milk. I wanted to consider these difficulties and examine three issues that problematize how the metanarrative was produced at the levels of medical theorising, diagnosis, and the social. Here I only cover each topic using broad strokes by introducing some examples that I think show that both belief and rationality are present in the processes of knowledge production.

Latour's *Science in Action* (1987) was an attempt to understand these processes by looking at the activities of scientists in the laboratory. The inability of science to have direct insight into reality inevitably leads to the fabrication of unstable theoretical accounts (Bruno Latour, 1983, 1999) (B. Latour & Woolgar, 1986) (Woolgar, 1988). All scientific theories have this problem, so like Latour, I see scientific method as a form of inquiry preformed within historically specific cultural, economic, political, and scientific contexts. This is particularly interesting to me because scientific explanations are simultaneously emerging from social circumstance and also acting as a structuring force that organises life according to its precepts. Therefore, it warns the public about the dangers of consuming unpasteurised milk, while also unintentionally operating as a destabilising mechanism that gives rise to raw milk activism.

The first paper looks at how associations between milk, germs, and illness are coordinated by referencing already existing philosophical regimes of signs. What is said about milk depends on which philosophical outlook is accepted as valid. Medical practitioners and researchers had problems explaining the role germs had in the causation of disease in the body. The moment at which health bodies became ill due to the presence of germs was an unobservable event. There were heated and ongoing debates about what was happening to and within healthy and sick bodies. I try to show the contested nature of theorising how germs as specific causes were in tension with ideas about environmental causes internal to the body and/or the social environments outside the body. It was interesting because it showed the difficulties researchers had in locating causality, and it showed that the philosophical-medical framework used to think about where causes should be located was determined by the framework the medical practitioner and researcher believed was the most representative of reality and therefore the proper starting point for evaluating evidence. The debate between monomorphists and pleomorphists is

interesting because it could not be resolved by appeals to empirical evidence at that time. As pleomorphists could not develop ideas about specific, mathematisable cause(s) of disease, they slipped into obscurity. Subsequently, pleomorphism has become a marginalised view, but a view still held by some homeopaths. The key point is that the lens scientists choose to observe the world posited connections between milk, germs, and illness that determined what causal pathways would become valid.

The second issue is similar but writ large. My key concern was examining how medical practitioners went about diagnosing illness in social spaces. Here I see medicine operating as a rationalist project. It uses theory to diagnosis illness while simultaneously selecting the evidence that justifies the belief in germ theory while ignoring cases that lie outside the theory. The correlation between germs and illness determined what counted as evidence and what should be counted. It became important to quantify social spaces in particular ways as a means of connecting the notion of germs as "invaders" attacking healthy bodies to mapping dangerous social spaces in order to manage illness. The third issue focuses on the difficulties scholars have in evaluating how effective pasteurisation technologies were in lowering incident rates. This debate is couched within the broader debate about the effectiveness of medical intervention versus preventative hygienic and sanitary reforms. I think these show that knowledge emerges within social contexts and this has influenced how milk was naturalised as dangerous.

**Paper Two**

This second paper substantially predates the other papers in this dissertation. As my thought processes developed, my language and use of concepts changed. In this paper I use the concept of the ideational regime to understand how scientists produce knowledge to make claims about reality. While there is overlap between an ideational regime and a metanarrative in that

they are both frameworks for organising thought, there are also differences. An ideational regime primarily focuses on the processes of knowledge production within a scientific context and refers to those rationalities, assumed meanings, and conceptual devices used to explain and organise reality. My use of the term was inspired by the unrelated work by Somers and Block (2005), but it is a concept that shows how solutions to crises do not challenge the existing status quo, but generate causal explanations that preserve it. I used this idea as a way to understand how scientists were configuring germs as the cause of disease in the late 19th century and early decades of the 20th century. It may be more useful to think of the ideational regime as another organising discourse within the broader context of science as a discourse (see O'Farrell, 2005). This is my current view of the idea of the ideational regime. It is an attempt to understand how a particular type of discourse about germs was theorised as the cause of human illness and how this theory now dominates and organises science as well as contributes to the configuring of the metanarrative.

My study of milk reveals that 'how we theorise what we observe' does not always mesh with 'the totality of what we experience'. Therefore, governments are required to act in the face of uncertainty, particularly at moments of crisis when social stability is threatened. How political, scientific, economic, and social activity was organised around this uncertainty is the theme of the second paper. That uncertainty produced ideational regimes and resulted in biopolitical forms of governance.

The basic idea of this paper is that "ideas matter" and they have enormous impact on organising social relations as well as our engagement with the physical world. The construction and regulation of the social depends upon people's ideas about how to order their experiences. I think this is an under-discussed issue with respect to milk. Even though germ theory had become

widely accepted prior to WWI, very little was known about how germs made people ill. Germ theory could not explain the randomness of infections, determine the virulence of germs, or explain how germs interacted with their environments. Germ theory rested on a set of unverified assumptions and depended on assembling a larger lexicon of correlations between germs and diseases using statistical analyses tied to an ethic about what were the tolerable thresholds of risk. From these circumstances came my notion of an ideational regime for explaining how uncertainty was translated into certainty. I discuss this translation process at some length to show how pasteurisation technologies became supporting evidence justifying an acceptance of germ theory.

The uncertainty inherent in germ theory meant policymakers had to shift their focus from curative issues to strategies of prevention. The concerns of government were much broader than the concerns of experimental scientists seeking to confirm or disconfirm germ theory. Policymakers had to seek a balance between 'doing enough, but not too much' (Nadesan, 2008, p. 27). Their efforts to control mortality rates throughout the entire population by modelling the statistical probabilities of becoming ill from drinking milk made it a permanent threat to health—a biopolitical form of governance that made individual cases of illness an endemic threat to the whole population (Foucault, 2003a, pp. 242-248). Identifying germs as the specific cause of disease made the introduction of pasteurisation technologies a sensible form of medical intervention. It also made targeted public policy possible and would become an end in itself.

There were other issues confounding the introduction of pasteurisation technologies. The paper discusses the impracticality of alternatives to pasteurisation because of the administrative and scientific inability to monitor the production and distribution of milk on a large scale. The notion of *nutritional equivalency* is also raised for the first time. It is the idea that the use of

pasteurisation technologies was justifiable because there is little nutritional difference between pasteurised and unpasteurised milks. I look at the ways in which the nutritional value of pasteurised and unpasteurised milk was constituted through problematic research designs and reducing nutritional claims to the presence of vitamins and minerals in milk.

Finally, the paper looks at the relationship between effective biopolitics and the economy (Larsen, 2007). Larsen claims only through analysing the intersection between the biopolitical rationality to govern populations and the economic rationality of regulation does the complexity of governing become clear (2007, p. 16). Liberal market forms become the technological means through which biopolitical ends are achievable. Rather than markets acting as limits to government intervention, markets and biopolitics are aligned through those quantified relations and become the technologies of self-regulation (2007, p. 17). Pasteurisation technologies were but a new instance of this relationship. The emergence of pasteurisation technologies did not originate with the state in response to a particular health crisis. Rather, the management of the populace was amendable to the deployment of those technologies as they became available and were implementable within the existing economic form. The rationality of intervention takes the form of normalising and regularising new patterns of life. These new patterns are coordinated by the precepts of an ideational regime that align the germ theory of disease with the administrative capacities and economic interests of the state. Because this gap between experience and policy had not been closed, the propasteurising state sought to close that gap by maintaining the economic-scientific necessity of its position.

The ideational regime built up around milk has long since used compulsory pasteurisation laws as a political technology to justify and organise knowledge that connects people to milk in ways that preserve political, economic, and scientific interests. Pasteurisation technologies, germ

theory, and nutritional equivalency allowed milk to be configured as nutritious, safe, and affordable. As a political technology, pasteurisation laws preserve milk as a regional and global commodity that marginalises dissenters, eases the burden of government oversight, protects producers and regulators from litigation, safeguards science as the dominant interpreter of reality, and substantiates the norms of reductionist scientific theories, thus securing them as the bases for setting regulatory standards and policy guidelines.

**Paper Three**

My third paper deviates from the genealogical types of analyses done in my first two papers. Nevertheless, it is still a genealogical fragment within the larger context of this project. The paper examines how the scientist and activist engage one another today within a bureaucratic capitalist environment managed through the prescriptions of a neoliberal preventative healthcare paradigm. It positions raw milk activism as a lifestyle movement that challenges the need for compulsory pasteurisation laws. The premise of the paper is that raw milk activists, in order to have legitimacy as a lifestyle, must be able to demonstrate that raw milk is nutritionally superior to pasteurised commercial milk and that the risks attributed to raw milk are overstated by the propasteurising state. The gap between compulsory pasteurisation laws and drinking raw milk safely has unintentionally opened up space for resistance. Raw milk activists—as nomads—challenge the royal science that categorises pasteurised milk as nutritional and safe within the context of a *bureaucratic capitalism* (Sjoberg, 1999). This view of capitalism prioritises the production and distribution of commercial pasteurised milk as well as the biopolitical efforts of a preventative health paradigm that characterises raw milk as dangerous.

The Weston A. Price Foundation (WAPF) is a very proactive actor in this challenge. They have a large website with information addressing the nutrition and safety of raw milk as well as countering state regulators. However, the point of this analyses is to examine what arguments are being deployed by activists and the propasteurising state to serve their competing interests. My analysis is not intended to evaluate the arguments either side employs, but to contrast the competing paradigms used by either side to tell their stories about milk. Pasteurised milk is made nutritious using a reductionist approach to nutrition that sees milk as a liquid medium for transporting nutritional components. Activists, on the other hand, take a more holistic approach to nutrition where they argue foods like milk are living bio-matrixes that deliver health in a variety of complex ways that are compromised by pasteurisation technologies. Similarly, I examine how risks around drinking raw milk are contested. In particular, I look at how a CDC report (Langer et al., 2012) is being contested by WAPF (Hartke, 2012, Feb 22) and the recent failure of a legislative initiative (SB201) in California did not change the current law governing milk.

I find it interesting that the issues of milk nutrition and risk are really being contested through two competing paradigms about what constitutes health and what would affect how medicine would be practiced. The activist is not just challenging the state for the right to drink raw milk; they are also challenging neoliberal forms of governance. *Bureaucratic capitalism* (Sjoberg, 1999) is part of the neoliberal project that protects monopolising corporations that are capable of producing milk that can be traded cost-effectively over long distances and remain profitable. Reductionist, quantifiable attributes mapped onto milk make it a viable and valuable corporate commodity. Raw milk activists are also a challenge to the preventative health paradigm that requires individuals to be ‘healthy citizens’ (Petersen & Lupton, 1996), but

healthy only in the sense that individual choices are aligned with state prescriptions about what makes milk nutritious and safe. I think this is an important analysis because it begins a process of unpacking the beliefs and practices surrounding milk and provides some insight into how science produces and deploys knowledge that intersects with other interests. More importantly, this type of analysis will become more essential as the language of science is used to authorise and manage people's lives.

**FIRST PAPER**

# Pathologising Milk:

# Constituting Milk as Dangerous During the 19th Century

**Abstract**

The experience of drinking milk is now primarily an effect of expert systems of classification and metrics organised in accordance with the germ theory of contagious disease codified during the 19th century. Positing germs as the cause of disease provided medicine with a simple, unified, universally applicable modality for inferring the causes of contagious disease. Its acceptance by the scientific community would refocus public health policies on the management of pathogenic exposure. Milk was also subjected to this same form of management. Despite the dangers attributed to milk, pasteurisation technologies protected milk's status as an essential food necessary for the maintenance of health and convinced policymakers in Canada and the United States to enact compulsory pasteurisation laws as a necessary preventative strategy for saving lives and preventing future illnesses coming from drinking milk. This alignment of germ theory, pasteurisation technologies, and regulatory systems has since generated a metanarrative naturalising unpasteurised milk as a dangerous food. Reconfiguring unpasteurised milk as dangerous is contested, however, and continues to operate as a discursive space for today's raw milk activists who continue to advocate for the legal right to drink unpasteurised milk. This paper employs genealogy as a form of critique that problematizes some of the contested and unconfirmable analyses and practices that structured the practices of scientific theorisers, researchers, medical practitioners and policymakers in relation to milk. The paper is organised into three brief genealogical excavations. The first resurrects one of the debates happening in the 19$^{th}$ century about how the role of germs should be conceptualised in the onset of illness. Secondly, I examine how the acceptance of germ theory would change how society would interact with milk and how medical practitioners would diagnose sick bodies. The second excavation raises the issue of how diagnostic practices were supported by organising non-corporeal spaces as empirical evidence and then using those findings as a diagnostic

template for determining our interactions with milk. The third excavation looks at the controversy of how effective medical-political intervention was in lowering the incidence rates and prevalence of illnesses associated with the consumption of unpasteurised milk.

*Keywords*: Genealogy, germ theory, milk, quantification, pasteurisation, uncertainty

> A great deal of writing on the history of health reflects a naive awe of the medical profession, an awe which the facts do not always support. (Matossian, 1985, p. 7)

> Germ theory was one of the greatest of all scientific simplications [sic]. (Stewart, 1968, p. 1077)

The experience of drinking milk is now primarily an effect of expert systems of classification and metrics organised in accordance with the germ theory of contagious disease codified during the 19th century. Positing germs as the cause of disease provided medicine with a simple, unified, universally applicable modality for inferring the causes of contagious disease. Its acceptance by the scientific community has refocused public health policies on the management of pathogenic exposure (Wootton, 2006; Worboys, 2010). Milk was also subjected to this same form of management (Atkins, 2000; Latour, 1988; Worboys, 2000). Despite the dangers attributed to milk, claims were made about how pasteurisation technologies protected milk's status as an essential food necessary for the maintenance of health (Burks, 1911; Frank, 1934; Hanna, 1917). The availability of these technologies was used to convince policymakers in Canada and the United States that enacting compulsory pasteurisation laws was a necessary preventative strategy for saving lives and preventing future illnesses coming from drinking milk (Health Canada, 1993; U.S. Department of Health and Human Services, 2011). Efforts to standardise milk safety using pasteurisation technologies then began in earnest in the early decades of the 20th century (Atkins, 2000, 2010; Ostry, 2006; Smith-Howard, 2014). These policies were first instituted at the municipal level in Chicago in 1908 and then Toronto in 1918; they then expanded to the provincial/state level: first to Ontario in 1938 and later to Michigan in 1947. This alignment of germ theory, pasteurisation technologies, regulatory systems, and illness

has formed a metanarrative around milk that has naturalised unpasteurised milk as a dangerous food.

Reconfiguring unpasteurised milk as dangerous has been contested, however, because the assertion of this danger could not explain why some people became ill while others did not when drinking unpasteurised milk. The recognition of this gap between the metanarrative of milk as dangerous and therefore as requiring pasteurisation under all circumstances, and the personal experience of drinking unpasteurised milk safely, continues to operate as a discursive space for today's raw milk activists, who continue to advocate for the legal right to access unpasteurised milk (Douglass, 2007; N. Johnson, 2008, April; Madden, 2008, February 23; McAffee, 2004; Pickard, 1997; Planck, 2006; Schmid, 1997, 2003; Selick, 2009, January 26; Weston A. Price Foundation, 2011). I have used the concept of a metanarrative, first put forward by French philosopher Jean-François Lyotard (1979), as a way to think about how science conceptualised, and government began regulating, the public's interactions with milk. Lyotard thought metanarratives were problematic because they represent totalising explanations that attempt to explain events, experiences, and socio-cultural phenomena by appealing to universalising ideas and practices that come from having special epistemological and ontological insights into reality. The effect of a metanarrative is to foreclose on alternative explanations and deny the experiences that do not align with the totalising explanation asserted by the metanarrative. Milk has been subject to an institutionalised metanarrative that aligns scientific understandings of nutrition, germs, pasteurisation, and illness with pasteurisation technologies and public health policy.

The proponents of pasteurisation subsequently caricature any resistance coming from activists as socially irresponsible and scientifically unsound. They often criticise activists for ignoring more than one hundred years of evidence and research that the risks of consuming

unpasteurised milk are too great and unnecessary (Barry, 2009; Drape, 2007, August 8; FDA, 2006; Headrick et al., 1998; M. Johnson, 2008, April 10; LeJeune & Rajala-Schultz, 2009; McQuigge, 2006, December 7; Oliveira, 2007, November 22; Sheehan, 2005; Weir, Mitchell, Reballato, & Fortuna, 2007). The activists' challenges get reified and compartmentalised through sets of mutually exclusive oppositions—rational versus irrational, scientific versus unscientific, pasteurised versus unpasteurised, legal versus illegal, and individual choice versus public safety—that emerged as oversimplifications prior to the 1920s at a time when germs, pasteurisation technologies, legislation, and milk were being aligned as the explanation and justification for pasteurising milk. These simple oppositions have the effect of representing the world as given and incontestable, rather than as an expression of power used to decipher and order social relations to milk in particular ways. Binaries hide the contingencies and complexity that would otherwise undermine the stability of the metanarrative while producing cleavages in society (Foucault, 1990, pp. 83, 96). For the propasteurising activist, policymaker, researcher, and medical practitioner, these types of discursive practices circulate as authoritative explanations affirming the linkages that coordinate the metanarrative and depoliticise activist voices.

This paper problematizes the metanarrative using the genealogical method as a form of critique (Koopman, 2013). By examining some of the difficulties past actors had in effectuating medical claims and practices during the decades of the 19th and early 20th centuries in response to the crisis attributed to milk, I hope to provoke further discussion about how science operates as a specific mode of articulation that isolates variables as sites for intervention by removing them from their social context, but that does so from within an already existing ethical-social context. The production of scientific claims is already, in that sense, political and subsumed

within relations of power and cannot be separated from the production of knowledge (Foucault, 1984, p. 75). My analysis presumes Foucault's (1980) power/knowledge nexus and occurs at a high level of abstraction meant only to introduce three sites of contestation that point to the contingent and complex epistemological conditions that lie beneath the surface claims of the metanarrative.

The point of all three excavations is to show that scientific theorising and data collection are always mediated affairs that produce uncertainty and that continue to destabilize the metanarrative in the present. The first resurrects the debate in the 19th century between monomorphists and pleomorphists to show how the role of germs in the onset of illness was conceptualised differently by reference to already existing philosophical perspectives developed outside the medical field but used to frame medical discussions and produce causal explanations. This debate points to how different philosophical paradigms produce different ideas about the causes of illness.

The second excavation is concerned with examining how medical practitioners went about diagnosing illness in social spaces. Here I see medicine operating as a rationalist project where the interplay between theory and symptoms influenced what counted as evidence. The aggregation of similar cases was then used to organise non-corporeal spaces, which subsequently got used as a diagnostic template for determining people's interactions with milk. It became important to quantify social spaces in particular ways as a means of connecting the notion of germs as "invaders" attacking healthy bodies to mapping dangerous social spaces in order to manage illness.

The third excavation focuses on the difficulties scholars have had in evaluating how effective medical intervention has been in lowering the incident rates and prevalence of disease

by managing milk using pasteurisation technologies. This section is couched within the broader debate about the effectiveness of medical intervention versus preventative hygienic and sanitary reforms. For the most part, this debate is carried out in hindsight by scholars working within particular domains of thought that impose on history particular interpretations that continue to be contested and reveal the contingency and complexity of scholarly arguments.

**Problematizing the Metanarrative**

Genealogical method is a form of critique that problematizes what has become accepted by examining the contingencies and complexities that have since been marginalised or subordinated within the accepted narrative (Koopman, 2013, pp. 16-19). It is about uncovering and problematizing the conditions in which knowledge claims become possible and actionable (Kendall & Wickham, 1999, p. 37). It does not seek to contribute to a new telling of events, and there is no attempt here to provide alternative histories. The goal is to identify problems and then problematize those moments that have been used elsewhere as the official version of events to show that they also had their origins somewhere else, in some other context, mode of thought, or set of circumstances (Foucault, 1984, pp. 80-81). Histories also have histories that get lost when the past gets represented in ways intended to validate the current metanarrative rather than provide a simple retelling of past events (Dean, 2010). I use this approach to shift the focus from accepted historical and philosophical assumptions and bodies of knowledge to an examination of how medical discourses were constituting the relations of life through uncertain processes in a social environment that was also full of uncertainty, but nevertheless got reflected in medical practices and used to determine how illness and milk are connected.

This approach does not attempt to evaluate or justify what others were saying or doing. Rather, the genealogist only recirculates contested ideas and practices as way to reemphasise the uncertainty pervading those discursive struggles. There is no attempt to justify one point of view

at the expense of the other or draw from a pre-established or preauthorised body of texts. It is intended as an examination of how power operates by pointing to the shifts in belief and practice. This process always begins with ideas and practices that no longer have relevance or are in the process of being disqualified as unauthorised or illegitimate narratives hidden within a unified, systematised body of knowledge that draws attention away from the instability of dominant discourses (Foucault, 1980, pp. 81-85). The goal is to identify how constitutive structures that gave rise to ideas, debates, and events have contributed to the formation and reproduction of the metanarrative. What becomes significant for the scientist and general public alike is that we are all subsequently affected by these structuring ideas, events, and processes.

Mills (2003) has made several methodological recommendations for conducting a genealogical analysis that I follow in my analysis (pp. 110-116). She recommends a sceptical approach that searches for contingent circumstances in the archival material that suggest there are more complex ways for understanding how the present metanarrative emerged and is operating. Mine was a search for narratives, stories, and events that are often present but glossed over or appear as smooth transitions moving from one state of affairs to another rather than as contested histories. In my effort to explore a few of those moments of contestation, I used the statements found in scholarly analyses, government reports, and newspapers to examine the contingency of the metanarrative. These texts provided me with some of the historical content and context needed to situate my analysis, even while using those same texts as source for my critique. This strategy can be found in Part III of *The Archaeology of Knowledge* (Foucault, 1989a). Using that part of the text, I shift my focus away from an examination of how the statements in those texts come into being and rather focus my attention on the role those statements play in complex discursive formations. That is, my selection of statements depends on

the function those statements have in my analysis. I use texts as heuristic devices for understanding moments of contestation. I am not involved in a factual challenge of those texts. Rather, I select and use the statements and events found in these texts to show how they represent a challenge to the metanarrative.

**Issues in Tracing the Pathogenesis of Disease**

The acceptance of germ theory in the early decades of the 20th century was the foundational idea organising the metanarrative around milk. For at least the two centuries prior, people had interacted with milk in a variety of contexts. It was a civilised drink; a wholesome, nutritious food; an elixir for health; a medicinal curative; a dangerous bearer of disease; a commodity; the subject of contamination; the result of poor handling and distribution practices; and an adulterated substance manipulated by unscrupulous profiteers. These issues are variously discussed by scholars such as Atkins (1992), Czaplicki (2007), Dupuis (2002), Egan (2005), Phillips and French (1999), Worboys (2000), and Wright and Huck (2002), each of whom have examined some of the different historical circumstances that have defined milk. Activists such as Chapin (1907) and Hartley (1842) were promoters of milk consumption for the maintenance of health. Medical practitioners and researchers such as Burks (1911); Ehlers (1937, June 12); Hart (1897); Krauss, Erb, and Washburn (1933); and Montizambert (1901) were engaged in different debates about the efficacy of germ theory, pasteurisation technologies, and the management of ill populations using these theoretical and technological tools. Throughout this period, Burrows (1785), Macfadden (2006) and C. Porter (1911) were promoting unpasteurised milk as a curative for treating disease, and it was used in that role at the Mayo Clinic throughout the 1920s (Crewe, 1929, January).

From amid these multiple contexts, 19th century activists, politicians, medical practitioners, and researchers had an emerging function as arbitrators of health. Through their activities, the heterogeneous ideas, experiences, lineages, rationalisations, and social contexts surrounding milk were aligning with the medicalised views of milk. Medicine was becoming a new centre of authority attempting to coordinate the multifarious associations among dairy animals, milk, bacteria, farming practices, notions of hygiene and sanitation, nutrition, cultural expectations and habits, administrative capacities of the state, politics, and economic imperatives. Yet, within medicine there were competing and contradictory theories and disciplines that also contributed to complexities surrounding milk. Over time, the capacity of germ theory to coordinate all this divergent activity through a single, coherent explanation seemed an irresistible but problematic theoretical tool.

There are claims about the theoretical limitations of germ theory. While there is agreement that germs and contagious disease coincided, even as late as the 1960s, Stewart (1968) continued to discuss the inability of the theory to explain the numerous exceptions to it. That is, the theory could not explain why some people did not become ill. It also fails, according to Stewart, to give an account of the susceptibility of individuals exposed to germs or of how behaviour and/or socioeconomic circumstances act as determinants in the onset of illness. These are unaccounted for within the theory. Proponents of germ theory tended to downplay these other causes as germs became the "omnipresent, omnipotent [cause of illness], . . . dominating the biomedical zeitgeist" (Gross, 1998, September, p. 384).

For Bruno Latour (1988), a philosopher and sociologist of science, scientific activity is embedded within social networks where there are emergent moments of association, not scientific moments, but lived moments when an association emerges between two realities: in

this case, the fabrication of a causal association between the reality of consuming milk and the reality of the experience of illness. Ideas about what explained that experience could not follow from passively observing these two events. Notions of causality are negotiated in relation to other preconceived notions about causes. The acceptance of these causes depends on the ability of scientists to formalise explanations through definitional processes and the operationalization of categories (Hacking, 2000, 2002; Latour, 1999, p. 152). While germ theory was being accepted by medical practitioners and researchers, it remained at the time of its acceptance theoretically unaccountable to the randomness of infection, the virulence of different pathogens, and the degrees of interactivity between germs and bodies (Speake, 2011). These limitations get marginalised in conventional histories that connect familiar names and ideas to repeatedly tell the story about the "discovery" and acceptance of germs as the cause of disease. Histories, as stories of progress, move routinely from Henle's formalisation of germ theory in 1840 to Pasteur's 1862 demonstration that bacteria were present during the fermentation process to Lister's innovations leading to antiseptic operations starting in 1865. This is typically followed by discussions about Villemin's 1867 experiments describing tuberculosis as infectious and culminates in Koch's 1882 observation-classification of the *mycobacterium tuberculosis* bacterium as a cause of disease. These are readily identifiable events in historical texts and are repeated in the works of Duffin (2010), R. Porter (1997), Wootton (2006), and Worboys (2000). Of course, this is an egregious oversimplification on my part, but it nevertheless points to a common lineage of events used to describe how germs came to dominate medical theory and represent the legitimate way of conceptualising unpasteurised milk as dangerous.

While these types of scholarly histories have an important social function, the narratives they produce also provide slivers of information that can be used to contribute to my analysis.

Historian Michael Worboys (2000), for instance, wrote that the theorising of germs as the cause of illness would become the *lingua franca* of medicine between 1880 and 1900 and was operating as a new paradigm for thinking and speaking about contagious diseases despite opposition to it (p. 275). Using this new language, the medical community began a process of sublimating milk and the social spaces associated with its production, distribution, and consumption in ways that would subsequently reconfigure milk as an inherently dangerous food. It produced what geographer Peter Atkins (2010) called an era of "bureaucratic bacteriology" (p. 247) where the presence of bacteria in milk was viewed as bad for the consumer and refocused social interactions with milk through the lens of bacterial counts.

This is a different situation from the time prior to the acceptance of germ theory. Until germ theory became widely accepted during the early decades of the 20th century, public demands to clean up the various conditions affecting the milk supply did not get the traction desired because without access to specific aetiologies and causal explanations, political action was inconsistent and administratively and economically impractical (Wasserman, 1972). In this newly emergent bacterial era, healthy milk became germ-free milk (Atkins, 2010). What ensued were a range of public policies focused on a variety of hygiene and sanitation practices and regulations trying to control the bacterial content of milk in ways that would least alter its taste or nutritional content. The techniques of pasteurisation were the technologies used to coordinate these efforts.

The advantage pasteurisation technologies had over other approaches to cleansing milk was that they provided a single point of control in the supply chain just prior to the time of consumption. While politics often delayed the implementation of these technologies, the underlying belief that germ theory accurately described the causes of contagious diseases and

were an imminent threat to the public were not given as reasons for the delay. I found support for this position in Czaplicki (2007) and Wright and Huck (2002). Czaplicki attributed the delay to political reluctance to interfere in the market and the dubious efficaciousness of pasteurisation technologies, while Wright and Huck saw this delay coming from the court's unwillingness to enforce new legislation. Nevertheless, once pasteurisation policies were initiated, there were movements toward tighter political and legal oversight, which however unintentional would reify the view that milk was an inherently dangerous mode of disease transmission and drinking unpasteurised milk should be avoided.

In the lead up to that acceptance of germ theory, there were internal struggles within the medical community about what causes illnesses. Medical historian Cecilia Mettler (1947), in her book *History of Medicine*, provided some historical context about these struggles. Mettler wrote about Jenner's work on smallpox and cowpox vaccines in the 18th century as contributing to the idea that "etiologic agents" (p. 432) were involved in the onset of disease, but noted this idea had little currency throughout most of the 19th century. The main difficultly for the 19th century medical practitioner was the complicated task of connecting clinical descriptions of the experience of illness to a coherent set of unobserved references within the body (Canguilhem, 1988, pp. 55-56). These connections remained primarily conjectural even at the time of Mettler's (1947) writing. She reports that post-mortem observations of diseased bodies revealed little about the mechanisms of disease formation within them (p. 432). There was little empirical evidence; yet some idea about cause was needed to explain the onset of illness. It was an instance of the medical gaze linking symptoms and ill bodies through a theoretical construct, which in turn is used to inform the clinical examination (Foucault, 1989b, pp. 134-136). The acceptance of germs as the cause of disease was neither empirically nor theoretically obvious.

How germs were understood to interact with bodies depended largely on the practitioner's and researcher's philosophical orientation to medicine. These orientations act as intellectual technologies through which medical judgements can be assembled and made thinkable, actionable, and calculable (Rose, 1994, pp. 62-63). Medical historian Harris Coulter (1994b) made the case that the relationship between theories and ill bodies are rooted in binary thinking that oscillates between empiricism and rationalism, holism and reductionism, vitalism and mechanistic determinism, allopathic and homeopathic, and specific aetiologies and multifarious conditions. Coulter (1994b) argued that these kinds of philosophical binaries act as templates for structuring theoretical activity and then, once accepted, become an epistemological mode for understanding the onset of illness. Theory and practice throughout the 19th and 20th centuries, for him, occurred within these philosophical contexts that competed with each another for dominance. The binary sets the conditions for what becomes possible.

For example, Coulter (1994b) talked about the rationalist adopting a mechanistic approach that assumes bodies are machines made of fixable parts, each categorical description of symptoms directly corresponds to some specific underlying cause, and these descriptions are applicable to every person. This mechanistic approach was very amenable to an allopathic understanding of disease causation. That is, healthy bodies remained healthy until some external contagion disrupted their proper functioning, resulting in distinct pathological states. Treatment, therefore, focused on countering symptoms through various heroic interventions (Coulter, 1994b). In effect, allopathic-rationalists were at war with the environment, sought to eradicate the "causes" of disease, and came to dominance as the institutionalised metaphor of modern medicine after the 1890s (Worboys, 2000, p. 7). This dominance was closely tied to the work of Robert Koch and the rise of bacteriology beginning in the 1860s, which began promoting the

novel idea that the presence of bacteria meant bodies were contaminated, but could be isolated and cleansed through medical intervention (Gradmann, 2001). Under this model, germs were seen as the direct cause of disease.

This view differed greatly from the empiricist view (Coulter, 1994b). The empiricist typically adopted a vitalistic-holistic approach to the patient, which would eventually engender such disciplines as anatomy, physiology, pharmacology, bacteriology, microbiology, and nutrition. The practitioner relied on observation of the patient within his or her environment, but also the environment within the patient. In the empiricist's view, the body should be treated in its entirety, as a regulatory system in need of rebalancing as opposed to the allopath-reductionist who sought to find and fix specific causes (Coulter, 1994b). For the empiricist-vitalist, bodies interacted with and adapted to their environments, in which case, medicine had to be theorized and practised by analysing the continual movement between the internal workings of the body in an effort to harmonise bodies with their external environments (Canguilhem, 2008, p. 61). Empiricists' understanding of pathogenesis could not be traced to any one cause within the tissues of the body, and they rejected the view that generalised theories could be accurately applied to whole populations given the diversity of lived experience and the lack of empirical evidence. That is, different people would react differently depending on their social circumstances and individual health.

The eventual acceptance of "etiologic agents" (Mettler, 1947, p. 432) as the cause of disease only opened up other controversies about their ontological status and specific roles. Monomorphism and pleomorphism were 19th century speculative attempts to explain the role germs had in the processes of disease formation because germs as the direct cause of disease had never been observed, only inferred. In summarising D. Hume (1932), the monomorphist coded

germs as the singular cause of all contagious diseases. That is, each disease state was caused by a specific germ, and each germ was conceptualised as an entity made up of sets of immutable properties capable of invading healthy bodies and disrupting their immune function without actually interacting with the host environments. Pleomorphism, in contrast, asserted that pathological conditions were a consequence of the transformation of both germs and the host environment as they interacted with each another (D. Hume, 1932, p. 141). Under this model, germs were thought to be a symptom of disease, not its cause (Coulter, 1994a, p. 37). The implication is that healthy bodies did not become diseased because of an invasion from monomorphic germs because bacteria were already ubiquitous in the body and the environment, and were interacting with bodies in unobservable ways.

This debate about specific aetiologies was also being studied by medical researchers such as Claude Bernard (1813–1878). He argued the causes of disease were dependent upon the body's regulatory systems to maintain the health of the individual (Gross, 1998, September). According to Gross (1998, September), Bernard's view was that healthy bodies regulate themselves and did not necessarily become ill in the presence of germs; therefore, the focus of medicine should be on cultivating healthy bodies as a way to prevent illness. I looked back at two examples of how Koch's view of the role of germs in the onset of illness was being contested. In 1892, Elie Metchnikoff (1845–1916) and two of his colleagues drank dangerous doses of cholera-infected water (Metchnikoff, 1921). While reportedly Metchnikoff and one colleague did not become ill, the other became very ill but recovered. Metchnikoff (1921) concluded there were specific bacilli associated with cholera but inferred the exposure to those bacteria could not have been the direct cause of the illness (p. 155ff.).

In the same year, Max von Pettenkofer also drank what was believed to be a lethal dose of cholera without incident to disprove germ theory (E. Hume, 1927, p. 55). Koch responded by suggesting high levels of stomach acid prevented infection (R. Porter, 1997, p. 437). Regardless, what these events suggest is that a clear understanding of what role germs were playing in the onset of illness was unclear and remained mobile, indeterminate, and unconvincing. The presence of germs was not disputed. What was disputed was whether germs cause illness or whether bodies became ill because of a failure in a person's regulatory system to maintain a healthy state. Gross (1998, September) has suggested the latter, Bernard's view, was neglected for 50 years after he formulated it because there were no metrics for connecting his theory to treatment, nor were there sophisticated ways to model environmental conditions, whereas germs were easily isolated as a variable and could be acted upon.

The only thing certain in these accounts was that germs and illness coincided. The movement toward monomorphism could not have been determined by logic, observation (Stempsey, 1999, pp. 100-111), or the empirical evidence available at the time (Gradmann, 2001) (D. Hume, 1932, p. 239). Pasteur's monomorphism was displacing pleomorphism by ignoring, not refuting, research coming from other researchers such as bacteriologist Ernst Almquist (1852–1946) and biologist Antoine Béchamp (1816–1908; Béchamp, (1994). Latour (1988) has suggested that the acceptance of germ theory was due largely to Pasteur's force of personality and not his experimental activity. The acceptance of monomorphism was highly dependent on his ability to form alliances across a variety of audiences, each contributing to his credibility but none critically engaged in evaluating his claims (Latour, 1988). The empirical justification came much later by retroactively (and ironically) tracing that justification back through the successes attributed to the use of vaccines that had re-emerged during the early decades of the 20th century

(D. Hume, 1932, p. 244). This linking of a reductionist theory to technological innovation as a way to manage life has strongly contributed to what Angell and Demetis (2010) have called the "delusion of objectivity" (p. 131). For the monomorphist, claims to objectivity presupposed anatomical descriptions unmediated by perceptions. That is, choices about what anatomical features to describe seemed self-evident to the observer, and descriptions of altered anatomical states by that observer somehow revealed germs as the cause of those alterations.

The moment of transformation from healthy to diseased state had not been observed, only presumed, in the monomorphist's acceptance of the theory. One of the criticisms of scientific practices is that it claims to operate as if it is a passive activity for making visible a concept-independent reality already amendable to codification, quantification, and standardisation without any discussion of how research using scientific method introduces fallibility (Fleck, 1979; Latour, 1987, 1999; Woolgar, 1988). To quote historian David Wootton (2006), medical personnel "have to take sides" (p. 22) in these debates, and those decisions are often bound up in the social world of beliefs, expectations, and interests, or what he called the "history of emotions" (p. 25). Inherent in this kind of activity are the conditions for introducing fallibility.

There are philosophical arguments that attempt to present justifications for how science operates. What matters most about any scientific explanation is its internal consistencies; the more coherent the explanation, the more likely it is to be adopted as an epistemic backdrop for determining the truth value of a fact (Stempsey, 1999, p. 18). These judgements are always historically situated (Stengers, 2000, p. 29), organised through what D. Smith (1990) has called the normative order—that pre-existing social schema for interpreting the content and context of social relations (p. 87ff.). The normative activity that preserves germ theory is rooted in the acceptance of rationalism, reductionism, monomorphism, biological determinism, and allopathy

as explanatory forms founded on another assumption that these ideational camps were all evidentially based rather than rationalised approaches for interpreting evidence.

The association between milk and illness is said to have been in evidence since the first milkmaids appeared on the streets of London sometime between 1619 and 1641 (Slicher Van Bath, 1963, p. 284). Some urbanites became ill after drinking milk: typically infants, children, and convalescing adults (Bryder, 1988). Urbanites were put at greater risk as the geographical distances between producers and consumers of milk were expanded after 1750, separating the consumer from the producer across Europe (Pelto & Pelto, 1983). Separating the dairy producer and city dweller made milk more susceptible to bacterial growth because of poor hygiene and sanitation practices, the unscrupulous practices of profiteers, and lack of refrigeration and transportation infrastructure throughout the commodity chain. Despite these risks to infants and children, milk was promoted as a substitute for breast milk that for many women arose out of economic need to both contribute to the family income and feed infants and children (Mepham, 1993). Rising rates of illness, however, were negatively impacting the continued accumulation of wealth and contributed to a growing awareness of the need to secure the public's health (Latour, 1988, pp. 16-19). Reconciling these issues profitably meant milk would have to be aligned with the imperative to accumulate within capitalism.

Accepting a monomorphic model of germ theory made milk dangerous but cleansable. As theoretical explanation, it mobilised a view of cause that reimagined milk in scientific terms without acknowledging the other societal issues that would contribute to its acceptance: the administrative capacities of the state, the legal possibilities for regulating milk, and economic concerns about sustaining, accumulating, and producing milk safely. These different concerns came to produce institutional forms that acted as the necessary conditions for the production of

policy and the satisfaction of interests (Grundmann & Stehr, 2000) (Stehr & Grundmann, 2011). As such, scientific theorising is not merely the passive observation of a concept-independent reality. Foucault (as quoted in Sheridan, 1980) described it this way: "There is not knowledge on the one side and society on the other, or science and the state, but only the fundamental forms of knowledge/power" (p. 129). Pleomorphism slipped into obscurity because a specific, mathematisable cause could not be specified. Subsequently, it has become a marginalised view, but a view still held by some homeopaths today. Monomorphism is now the current form of germ theory employed to determine the conditions for thinking about how the public should relate to milk.

**Diagnosis as a Problem of Connecting Theory and Evidence**

Drinking milk was culturally unavoidable because of its status as an essential, affordable whole food for the maintenance of health. It was especially recommended for infants and children, which even in the early decades of the 20th century the Canadian government recommended be drunk unpasteurised unless circumstances warranted the consumption of pasteurised milk (Guard, 2010; Hanna, 1917). Nutritionists thought it to be an indispensable food for infants and children (Dupuis, 2002; Frank, 1934; Hartley, 1842; Mepham, 1993; Ostry, 2006; Ostry, Dubois, & Nathoo, 2006). Yet, milk was correlated with illness. How this contradiction was confronted depended very much on the theoretical lens adopted by the diagnostician.

Diagnosis is the art of linking life to some useful technique informed by a particular epistemological field (Canguilhem, 1991, p. 228). The legitimacy of diagnostic arts depends heavily on their capacity to operationalise the social as a manageable space by connecting it to multiple, interconnecting systems of classification (Rosenberg, 2002). The legitimacy of medical insight depends on separating medical claims from complex social environments. The

appearance of a separation becomes a way to control and manage urbanised and industrialised spaces characterised by poor health, poor living conditions, poor diet and hygiene, poorly designed urban spaces, and economic inequality. Medical science seeks legitimacy by translating qualitative descriptions of illnesses into operationalisable variables and explanations in order to effectuate medical intervention. This practice is problematic because it always introduces uncertainty about what counts as evidence when scientific observations are theory-dependent (Knorr-Cetina, 2005, p. 176; also Latour, 1983; Latour, 1987, *passim*). The translation of observation into statements of fact involves "chains of decisions" (Knorr-Cetina, 2005, p. 179) operating within scientific networks attempting to validate what was observed. These processes, I presume, are no different for how the metanarrative around milk has formed. The epistemological and ontological uncertainty inherent in scientific activity has suggested to Deleuze (1988) that there is nothing behind knowledge claims other than other accepted-acceptable claims. That is, the "facts" and the relationships between them are constituted discursively within discursive fields. Medicine manages that discursive activity by assembling causal pathways secured by generating statistical probabilities that correlate events.

The mathematisation of regularities creates the delusion of fixed and knowable ontologies about the nature of and the relationships between entities, which the state relies on to engage and manage the public (Hacking, 2000; Rose, 1999; Rosenberg, 2003). And, since only state apparatuses have the power to employ and deploy metrics, only those translations would be accepted as authoritative and credible (Deleuze & Guattari, 1987, p. 412; T. Porter, 1995; Rusnock, 2002). Once a particular view of the relationship between germs, pasteurisation technologies, milk, and illnesses had been formalised institutionally, diagnoses and treatments can be "retroactively described as deductions authorized by the paradigm" (Stengers, 2000, p.

118). This type of rationalising aligns diagnosis with theory by counting only those cases that support the theory, even though those "supporting" cases are unstable constructs—unstable in the sense that their identification also depends on aligning theory, systems of classification, and diagnostic practices.

**Two Examples of Concept-Laden Diagnostic Practices**

An example coming from Bibby (1944) provides some context and it demonstrates how these debates about what constitutes legitimate science go back and forth. The view that pasteurisation prevented future illnesses was widely accepted and promoted after the acceptance of germ theory. Bibby was critical of how readily this view was accepted. In particular, Bibby was critical of the work presented by Wilson (1942) in his book *The Pasteurisation of Milk*. In it, Wilson wrote about a series of studies done at Toronto's Hospital for Sick Children, where pasteurised milk had been available since 1915. One study done at the hospital showed that all the children infected with *bovine tubercle bacillus* (BTB), a nonpulmonary form of tuberculosis, came from areas of the province where pasteurised milk was unavailable. Had these children been drinking pasteurised milk, Wilson argued, they would not have become ill and found themselves in hospital. Bibby objected to Wilson's reasoning because his argument did not take into account nutrition, poor living conditions, and/or individual predispositions and susceptibilities to illness. The study, Bibby (1944) wrote, was also logically specious. That is, the only thing the hospital's study "proved" is that the children who were not exposed to BTB did not contract BTB. It did not show that these children would not have become ill if the milk had been pasteurised; it showed only that pasteurisation reduced the levels of BTB in milk (pp. 36-38). Bibby's criticism was that Wilson's analysis presupposed a theoretical view that any

exposure to BTB caused illness, therefore proving the efficacy of pasteurisation technologies. Bibby countered this using statistical evidence that I explore in the next section.

A completely different example arises from the work of British epidemiologist, government employee, and miasmist William Farr (1807–1883) and typifies how deductivism operates (Eyler, 1973; Halliday, 2000). Farr introduced what was then a novel approach to coping with disease when he began quantifying the correlation between illness and social conditions. In Farr's view, the prevention of illness depended on improving the living conditions of urbanites (Eyler, 1973, April). He thought it would be easier to prevent illness by controlling environmental conditions rather than curing ill bodies (Halliday, 2000). Halliday (2000) positioned Farr's work as a criticism of the dominant humoral approach, which had ambiguous notions of cause. According to Daly (2006), there were humoral, miasmic, and germ theories of contagious disease. Each had its own epistemological field complete with its own sets of adherents and lexicons of explanations for coordinating concepts and thresholds of risk. Diagnosis in the early decades of the 19th century was still rooted mainly in Galen's humoral theory of disease, which provided descriptive accounts of symptoms but had little insight into specific aetiologies (Daly, 2006). The goal of this approach was to (re)create some semblance of constitutional balance within the body and between the body and its environment. This competed with the miasmic theory of contagious disease that attributed the cause of disease to exposures to the smells emanating from decaying matter in the environment (Daly, 2006). Under this model, the causes of disease were external to bodies that were presumed to be healthy, and therefore disease could be managed by controlling the environment.

Farr also located the "causes" of illness to specific external conditions in the environment, which meant health could be restored by cleansing specific conditions found in the world

(Halliday, 2000). Ironically, even though Farr was committed to drawing causal lines between bodies and the environment, the strong statistical correlations between water and cholera outbreaks did not convince Farr to intervene at the site of water. He did not accept Henle's 1840 theorising about the causal role of germs or Snow's 1849 suggestion that water was a mode of transmission for disease-causing pathogens. In Farr's view, these were mere speculations for which there was little evidence (Halliday, 2000). What was acceptable as empirical evidence could not be separated from Farr's commitment to miasmic theory. What bits of the world got cleansed were mobilised in accordance with his ideational commitments about causes. He continued to believe that germs in the water did not cause disease. It was the smells, however subtle, that emanated from the water that caused illness. Only after the massive cholera outbreak of 1866 in London did he relent (Halliday, 2000), and water was subsequently understood as a mode of pathogen transmission.

I see two points worth taking from Farr's story that explains how medicine effectuated cause. The first is that his theoretical commitments colour what counts as evidence, and the second is that causes were selected according to those paradigmatic commitments. The gradual drift away from miasmic theory and toward monomorphism happened because the activities of the hygienist movement could be focused on a specific cause (Latour, 1988, p. 60). Since the only possible response to illness for the miasmic practitioner was to cleanse all the multifarious environmental possibilities thought to be involved in the onset of disease, no one locale could be acted upon, and under those theoretical conditions the problem of how to focus medical intervention remained, but solidified the idea that medical intervention could be done by controlling the environment.

Attempts to manage the environment were common. The two most common associations between milk and illness throughout most of the 19th century: the criminal activity of adulterating milk and/or the consumption of contaminated milk. Both of these problems persisted well into the 1920s (Atkins, 2000), primarily because laws pertaining to milk were seldom enforced until after the 1930s (Wright & Huck, 2002). One such scandal revolved around the production and distribution of "swill milk" that lasted until 1875 in New York (Egan, 2005). Newspaper articles pointed almost exclusively to the consumption of swill milk as the cause of death of thousands of children annually ("The Milk Trade," 1853; "Pure Milk," 1853). Hartley (1842) reported the first swill distilleries appeared in New York in 1814 because the recent war with Britain had cut alcohol imports from the British West Indies and created a demand for local distillation, particularly in urban centres. Alcohol and dairy production were subsequently co-located, and cows were kept in unnatural, unsanitary conditions and fed the nutritionally empty effluence from alcohol production. Hartley (1842) wrote that this practice was not confined to New York but was widespread in America and Europe (see also "Distillery Milk Report," 1887).

In a much later report prepared for the Canadian government, Hart (1897) continued to stress the continuing difficulties authorities had in managing the multiple environmental conditions that made milk dangerous. Hart complained about uncooperative authorities and businessmen involved in the concealment of infected-contaminated-adulterated milk, the continuation of poor sanitary practices by producers, problems of storing and distributing milk, un- or mis-diagnosed cases of milk-borne illnesses, the inability to trace outbreaks, and the indeterminate methods for determining the quality and quantities of distributed milk. Yet, despite these types of problems of managing the social environment (Halliday, 2000), Farr's work would permanently reconfigure milk as an extracorporeal site for medical intervention. Certainly,

propasteuriser Nathan Straus would later claim it was his rationale for wanting to distribute sterilised milk to New Yorkers after 1892 ("Sterilized Milk," 1893).

**Diagnostic Problems of Linking Tuberculosis and Milk**

Toward the end of the 19th century, germ theory was used to link tubercular cows, sick people, and pasteurisation technologies. There are, however, problems with these linkages. At the time, the techniques for diagnosing tuberculosis were rudimentary at best and relied upon visual techniques, percussion, and auscultation that made it difficult to determine the underlying causes within the body (Mettler, 1947, p. 281). Ultimately, diagnostic categories are descriptions coded as semiotic realities drawing on the "complex and multidimensional negotiations that configure and reconfigure the lives of real men and women" (Rosenberg, 2003, p. 250) to create the conditions for therapeutic intervention. By collecting and correlating symptoms, clinicians could project representations of causality and locality back onto bodies in accordance with the accepted medical theory (Armstrong, 1995; Foucault, 1989b). While these techniques revealed little about direct causes, they would lead to the subordination of experience to theoretical descriptions. The problem was that the diagnosis of tuberculosis in humans was uncertain and would have affected a reading back onto history the causes of illness using statistics.

At the end of the 18th century, the causes of tuberculosis (then called *phthisis*) were speculative and most often thought to be the result of a hereditary predisposition or a consequence of poor nutrition (Mettler, 1947, pp. 263, 774-775). Even so, Mettler (1947) wrote, it was often observed that patients with swollen lymph nodes (*tuberculosis adenitis*) often had intestinal problems. The observation of either symptom prompted a generalised diagnosis of tuberculosis. Eventually, clinicians reclassified this group of symptoms into two distinct types of tuberculosis: pulmonary and nonpulmonary (Mettler, 1947. pp. 398, 400). Only once Koch had

observed a correlation between specific bacterium and the various disease conditions observed in the body in 1882 could a monomorphic view of germs find acceptance. The artificial conditions of the laboratory used to conceptualise and organise the "empirical content" (Stengers, 2000, p. 23) of life are a way of reading on to bodies and the world "cures" (p. 26). It would certainly make the link between tuberculosis and milk sensible. Nevertheless, operationalizing theories in a laboratory was fraught with difficulties. The processes of isolating particular variables as causes while excluding others was problematic and not always clearly delineated, yet it was and remains the most practical means of making the world scientifically intelligible (Latour, 1983; Stengers, 2000, p. 23; Sturdy & Cooter, 1998). The ability to model germs as the simple or singular cause of illness would further solidify a monomorphic understanding of the aetiology and pathogenesis of illness.

This knowledge did not make clinical diagnosis any easier. It still relied on reading symptoms. Pulmonary forms of tuberculosis are a human strain of tuberculosis (MTB); its symptoms are distinct from those of BTB. BTB was more commonly associated with abdominal, nonpulmonary symptoms and was a common strain found in milk. Only the human and bovine forms of tuberculosis cause illness in humans. BTB mostly affected children and infants under the age of five and accounted for 85 percent of the total number of cases of nonpulmonary tubercular infections (Bryder, 1988, p. 133). These difficulties can be seen in Koch's (1901) observations during post-mortem autopsies. He found that both pulmonary and nonpulmonary symptoms associated with tuberculosis were almost always present in tubercular patients. Moreover, the ability to distinguish between MTB and BTB did not exist until after 1898 (T. Smith, 1898). However, while observing this difference in a laboratory contributed to a growing belief in monomorphism, clinical diagnoses could not contribute to the reliability and validity of

monomorphic claims because MTB and BTB were not reliably diagnosable without post-mortem analyses until the 1940s (Wilson, 1942, p. 22), and no treatments for either were available until after 1942 (Wootton, 2006, p. 16). Even today, the virulence of BTB is unclear and often surfaces in patients who already have other immune suppressing illnesses (Grange, 2001; N. Johnson, 2008, April; Thoen & LoBue, 2007).

According to historian Matossian (1985), the incidence of pulmonary tuberculosis peaked between 1807 and 1814 and then dropped precipitously after the 1830s until around 1840–1844 to a fairly even decline from 1845 onwards, a shift she attributed to changes in diet. A discernible pattern was recognisable. The potato, which was replacing wheat as a staple food as wheat became too expensive, did not contain any of the mycotoxins found in bread, which acted as immunosuppressants that made otherwise healthy people susceptible to tuberculosis (1985, pp. 193-195). Historian Linda Bryder (1988) also wrote that all forms of tuberculosis were in a steady decline from 1860 to 1950 throughout England and Wales, but remained higher among the poor and unemployed (pp. 7, 129). Bibby (1944) similarly found a steady decline in incident rates after the 1850s. Unlike Matossian, who found changes in diet resulted in observable declines in pulmonary tuberculosis, Bibby found no comparative decline in incident rates of tuberculosis after the introduction of heat treatments to milk such as boiling, pasteurising, or sterilising, or eradication programs in the 1880s and 1890s (p. 10). In other words, there was no discernible pattern in the data where there should have been one.

Given these statistical patterns, Bibby (1944) argued that the pasteurization of milk could not account for this decline and that statistical analyses of tuberculosis are also misleading if they do not distinguish between the pulmonary and nonpulmonary forms of the disease. Bibby stated that it is statistical illusion to claim that there has been a greater decline in nonpulmonary

tuberculosis than in pulmonary forms because of the introduction of pasteurization. He argued that Wilson's claim that children are not getting sick because they are consuming pasteurised milk is not in evidence (p. 50). Yet, if pasteurisation worked under a germ theory model, as Wilson believed it did, then, Bibby argued, the rates of nonpulmonary tuberculosis should have dropped precipitously faster than pulmonary forms of tuberculosis after pasteurisation was introduced. However, there are no statistics showing that to be the case (pp. 22-35). In addition, incidents were declining even though BTB was endemic in European and American cowherds (Olmstead & Rhode, 2004). According to monomorphism, incident rates from BTB should have dropped precipitously faster than the rates for MTB if pasteurisation technologies or any other policy meant to control infections from drinking "infected" milk were having the effects predicted by a monomorphic view of germ theory. Bibby (1944), however, found no such statistical outcome, and this suggests there were either problems with clinical diagnostic practices, diagnostic categories, or the reporting of BTB cases, and/or germ theory is not a complete account of illness. These attempts to understand the relationship between milk and illness remained problematic.

**Problematizing the Social Causes of Illness**

Statistical representations are always problematic because they generate standardised narratives that generalise the health of whole populations. Though useful, these representations have transformed medicine into a system of surveillance that operates by determining what counts as risky and how those risks should be managed across whole populations (Armstrong, 1995). Reading risk depends on amassing and aggregating cases and then correlating the similar cases as a way to support a particular description of events.

This type of framing practice has generated two competing narratives about what was causing the decline in incidence rates and the prevalence of contagious diseases. The first account argues that the development of medical theories through research led to the invention of technologies that were directly responsible for declining incident rates of contagious diseases. This has been the predominate position of medicine and rests on the claim that scientific activity has special insight into reality from which the techniques of intervention follow (Mulkay, 2005, pp. 104-105). The second account argues that preventative forms of intervention involving the cleansing and regulating of environmental conditions was responsible for those declines because the data consistently showed contagious diseases were in decline before medicine had the ability to intervene (Harris, 2004; Leavitt & Numbers, 1985; McKeown, 1979; McKinlay & McKinlay, 1977; "The Pasteurization of Milk," 1914; Wootton, 2006). Certainly, Bibby (1944) made this argument with respect to declines in BTB and pasteurisation technologies. Along these lines, Cutler and Miller (2005) attributed most of that decline to improvements in water sanitation. Farr's (as cited in Halliday, 2000) conviction that the causes of disease were environmental gave rise to preventative public health measures designed to prevent the spread of disease and became "widespread and systematic" (McNeill, 2000, p. 195) after 1850 in the United States. Pasteurising milk was viewed as an important contributor to these declining rates of disease and therefore was increasingly viewed as an essential policy to protect the public (Health Canada, 1993; Wilson, 1942).

How statistical accounts are compiled to support these positions matters, especially since trends in mortality and morbidity are used to defend the current metanarrative. Statistical data collected in Britain, Canada, and the United States about the causes of death and mortality rates have been said to be unreliable and incomplete up until the 1940s (Haines, 2001; McInnis, 1997).

Much of that data was unstandardized, and later attempts to standardise those disparate accounts by subsuming "similar" categories under a single more generalised category introduced more biases and errors that affected readings of the data (Hardy, 1994). While this type of reconstructed data provides more reliable categories for analysing historical trends and appears to speak directly to the specific causes of illness and death in support of public policy, the categories are much less informative because they often removed qualitative statements that would otherwise further contribute to medicine's knowledge of individual cases of illness (Anderton & Leonard, 2004). These critiques speak to the difficulties of reading histories and then reading back on to history ordering narratives.

Within this context, there are specific doubts about measuring the efficacy of pasteurisation practices. Many academics writing about milk think it remains an open question whether compulsory pasteurization laws and technologies dramatically altered health outcomes (Alter, 1997; Atkins, 1992; Bibby, 1944; Duffin, 2010; Fairchild & Oppenheimer, 1998; "The Pasteurization of Milk," 1914; Latour, 1988; Long, 1940; McInnis, 1997). There were persistent questions raised at the time about the efficacy of these new pasteurisation technologies, as were concerns about its inconsistent use and general lack of availability (Jenkins, 1926; Savage, 1933). In England, where statistical accounting began, attempts to begin standardising collection practices did not begin until after 1837. But even then, the proper registration of the causes of death was not "reasonably complete" (Matossian, 1985, p. 185) until after 1861 and not compulsory until after 1874. Dolman (1941), writing in the *Canadian Public Health Journal*, contributed to this confusion when he recorded that between 1913 and 1939 there were 67 outbreaks of disease attributed to milk involving 8,348 cases resulting in 740 deaths attributed to post-milking contaminations. Infections and deaths from bovine tuberculosis and brucellosis

were estimated to have caused an additional 2,000 deaths annually, a large number for which Dolman cites no evidence.

Other data have suggested that in the decades prior to WWII, mortality rates from milk-borne diseases were three times higher in the city of London, where pasteurised milk was more widely consumed than in the countryside, where most people still consumed unpasteurised milk (Bibby, 1944, p. 56). Higgs (1973) estimated urban deaths from all causes were fifty per cent higher than rural deaths at their peak during the 1880s. These trend lines narrowed significantly by the 1920s but did not disappear in the United States until after 1940, which Haines (2001) attributed to the uneven implementation of public health measures across the country. Statistics gathered at the national level are even more inconclusive since they reduce vastly different social and geographical contexts to monocausal explanations (Alter, 1997, pp. 102-105). Even in hindsight, the safety of milk in rural areas remains virtually unknown, and the efficacy of pasteurisation where employed in urban centres is unclear and makes comparisons with urban conditions untenable.

Fairchild and Oppenheimer (1998) have suggested that the dearth of analyses on the role pasteurisation played in the declining incident rates of BTB is attributable to the fact that the answers to the causes of illness fall outside the theoretical constructs of monomorphism. What the model could not explain, it ignored. Monomorphism made the experience of milk comprehensible, and to entertain alternative accounts can only lead to theoretical crisis. This crisis may be unavoidable because, as Kuhn (1996) has pointed out, when a theory cannot sufficiently explain the exceptions to it, there is a paradigm shift. This shift has been avoided by the way medicine is practised. The research of Mol and Berg (1994) has suggested theory and practice are treated as separate and distinct aspects of medicine, and this separation allows

practitioners to pre-empt questions about the inadequacies of theoretical claims and prevent them from being challenged. The appearance of a separation between them makes it appear as if scientific theorising, unlike medical practice, is uninfluenced by outside cultural forces. Mol and Berg concluded that whenever the "causes" of disease are located outside the coordinates of a theory, those problems are attributed to the clinical complexities of diagnosing life and not interpreted as undermining the theory.

Using statistical accounts as diagnostic templates only adds to the problems of diagnoses. Because germ theory is the accepted paradigm, the practice of medicine depends on either determining what level of exposure to germs make a person ill or deciding how many cases of illness attributed to milk would be acceptable. Canguilhem (as cited in Sinding, 2007, p. 266) has argued that what counts as acceptable is always bound up with ethical considerations that get deployed alongside scientific explanations to mask the inadequacies of scientific concepts. The immediate priorities of propasteurisers like Straus (1977) were to boil or pasteurise milk to prevent future cases of illness until such time science could find ways to make it safe. Since science was unable to provide metrics for determining the threshold between dangerous and not dangerous, governments often deployed controversial policies that took those inadequacies into account. Under monomorphism, for example, eradication policies sought to slaughter every tubercular cow on the premise some people may become ill some of the time. This was not a popular policy, according to Rosencrantz (1985), because it overstated the dangers attributed to milk.

In the meantime, if the conditions for saving lives depended on aligning effective clinical practices with policy in accordance with germ theory, then a lack of certainty about the causes undermines the determination of risk. This leads pro- and anti-pasteurisers into the paradox of

asserting and assessing life through the morally charged binary of dangerous and not dangerous that gets glossed over whenever governments claim public policies are science-based and necessary for the protection of rights and the safety of the public (Luhmann, 1993, p. 146). Pasteurisation technologies were a manifestation of these medical practices, and were subsequently formalised as the accepted-acceptable view of how to interact with milk as a mode of pathogenic transmission for a variety of diseases, even though the real impact of pasteurisation technologies on incident rates remains unclear and monomorphism remains incapable of explaining the randomness of infections or the virulence of germs. Taken together, then, the processes of validating the pasteurisation of milk become clearer: monomorphism made milk dangerous and milk as a mode of transmission using pasteurisation technologies validated monomorphism. Ultimately, these encounters have become ideationally and rhetorically reified fields that scientize the social in particular ways that have resulted in the institutionalisation of standardised, routinized techniques and technologies that subordinate experience to scientific models of disease formation that are internally consistent and self-referencing.

**Conclusion**

Scientific theorising and the practice of medicine operate by creating equivalencies between medical theories and medical practices, and they do so by mathematizing the relationship between the two. Points of contestation emerge throughout the processes of classifying and explaining how and where medicine should intervene. Of the three excavations introduced here, each indicates that even a cursory analysis points to some of the difficulties of coding and mobilising causal explanations, which were then used to coordinate the metanarrative. Complex social forces, of which science was one, were arriving at different understandings of what milk was in relation to the dangers associated with it. The inability of medicine to “discover” the precise causal mechanisms of disease subsequently dissolved the

distinction between bodies and the environment so that in the case of milk, it became the manageable cause of disease located outside the unknowable body (Speake, 2011). The body remained a conceptual black box that clinicians sought to circumvent by controlling and managing the levels of exposure to these disease-causing "invaders" found in milk using pasteurisation technologies.

The acceptance of monomorphism was rooted in its quantifiable utility. A pleomorphic understanding could not easily attach itself to milk since germs were ubiquitous and in various states of transformation depending on the intensity of the interactions with their surroundings. Monomorphism, in that respect, was satisfying in two ways. The scientist could make authoritative and credible claims about the causes of disease, and then introduce standardised diagnostics and treatments. Policymakers were afforded an opportunity to focus on pasteurisation technologies and deemphasise their commitments to a more onerous range of alternative policies that would have required the dedication of more government resources.

Expressions about causation were mobile and coordinated within theoretical frameworks so that medicine was capable of theorising, diagnosing, and intervening in daily life. As pasteurisation technologies became available after the 1890s, medicine focused on making pasteurisation technologies more efficient rather than raising questions about the veracity of germ theory itself (Latour, 1988, p. 52). This formalisation of the relationship between germs, pasteurisation, and illness began a movement toward enacting compulsory pasteurisation laws. What the history of disease control shows is that once an efficacious method of controlling a disease is found, it spreads rapidly (Johansson, 2003, p. 722), even when the relationships between theory, technology, and life cannot be fully explained. Nevertheless, these limitations were folded into medicalised fields that, as Mol and Berg (1994) pointed out, maintain their

authority and credibility by throwing up barriers between theory and practice. On the theoretical side, medicine claims to know the specific causes of disease, while on the practical side, aggregated statistical accounts operate as if there are known, safe thresholds of exposure for which there were no accounts at that time.

Stengers (2000), in realising the difficulties of generating scientific explanations, wrote,

> [It] is not easy to resist without reference to a past we would like to regret, and all the less so insofar as what we are resisting designates this past as outdated, and the future as a promise already disqualifying the present (p. 151).

Just so: this is the promise and difficulty of accepting medicine as anything other than a useful artisanal activity. The problems discussed here point to those possibilities for regret and suggest the present orientation toward milk as dangerous is being disqualified because accounts of scientific theorising and practice reveal how uncertain those processes were at their moments of actualisation. Not only were the practices of theorising, classifying, and counting cases uncertain, what narratives about those processes count as valid add another dimension of uncertainty about what were the actual dangers of drinking milk at that time. This uncertainty surrounding the early generation of scientific claims means the present is unstable as well, and new ideas can be introduced and new avenues of research pursued.

Today milk as cultural norm and scientific object of control are deeply interpenetrating expressions constituting the public's daily experience of drinking milk. Since science became a productive force in society during the 19th century, where any consumer of milk does not (and perhaps should not) imagine a future where the scientific management of milk will end. Even today's milk activists are not calling for the withdrawal of scientific intervention, but for a

reimagining through scientific inquiry of (1) how milk is conceptualised as healthy or dangerous and (2) whether those reimagined representations of the relationship between germs, pasteurisation, bodies, and illness could be used to leverage changes in the economic structures of accumulation and the political policies that support them.

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**SECOND PAPER***

# Infectious milk:

# Issues of pathogenic certainty within ideational regimes and their biopolitical implications

**Abstract**

Throughout the 19th century and early decades of the 20th century, milk was a dangerous food that required state intervention to make it safe. Throughout this period, the germ theory of contagious disease came to prominence, but could not explicitly determine the causal relationships linking germs, milk, and human illness. Using the notion of an ideational regime, I examine how (1) knowledge claims move from uncertainty to certainty and become privileged claims within ideational regimes that (2) result in an unintended, but necessary deployment of a biopolitical strategy for governance. The argument here is that theoretical uncertainty meant managing populations as a uniform undifferentiated reality using pasteurization technologies. I use two historical moments as evidence of these processes. The first is the 1901 British Congress on Tuberculosis when I argue germ theory came to a theoretical standstill and the second is Ontario's 1938 amendment to the province's Public Health Act that permanently institutionalised province-wide compulsory pasteurisation laws organised around the notion of nutritional equivalency. This genealogical exploration should provide some insight into how bacteria became the singular cause of illness and into the conditions that led to targeting milk as the main site of intervention instead of treating individual bodies.

*Keywords*: Biopolitics, British Congress on Tuberculosis, Ideational regime, Inferential networks of knowledge, Koch, Milk, Ontario, Ontology, Pasteurisation, Nutritional equivalency, Public Health Act of 1938, Scientific uncertainty

"To act, it is at least necessary to localize." Georges Canguilhem

Throughout the 19th century and early decades of the 20th century, milk was a dangerous food that required state intervention to make it safe. In examining the processes through which milk became safe, this article starts with the proposition that the emergence of pasteurisation technologies after 1886 and the subsequent movement toward compulsory pasteurisation laws that began in Chicago in 1908 occurred because the germ theory of contagious disease could not explicitly determine the causal relationships linking germs, milk, and human illness. The argument here is that theoretical uncertainty, not certainty, led to widespread support for pasteurisation technologies. The lack of theoretical certainty in treating individual cases of illness mean managing populations as a uniform undifferentiated reality using technologies precisely because scientists could not explain why some person became ill while others did not when exposed to the same disease-causing pathogens found in milk. The pastoral techniques (Nettleton, 1997, p. 211) of governing the health of populations were an extension of that uncertainty organised through the expert rationalities, ethical considerations, economic imperatives, and political possibilities of protecting people from the dangers of infected milk. Germ theory only made the role of pathogens partially visible. Pasteurisation technologies made up for that shortcoming by providing a preventative strategy for eliminating all forms of bacteria in milk. Pasteurisation techniques could not discriminate between pathogenic and non-pathogenic forms of bacteria; at best, they could reduce the number of bacteria present in milk, and it strategically applied just prior to consumption minimise the risk of further contamination.

Despite this uncertainty, the simple narrative that pasteurisation was necessary to make milk safe came to symbolise a complex set of circumstances that have since become obscured. This obfuscation was accomplished by valorising scientific explanations that were amenable to

statistical modelling and the administrative strategies of government. It strengthened the rationality for laboratory work, legitimising an empiricist, reductionist, monocausal approach to scientific theorising, and solidifying the need to govern using statistical data and standardized administrative techniques organised around scientific theorising and pasteurisation technologies. This article concludes by suggesting that these pasteurisation technologies continue to make theoretical uncertainty and slow that further development of theory, while at the same time creating the ideational space for alternative hypotheses and the deployment of different technologies and techniques for managing and eliminating diseases transmitted through milk.

The challenge now is to uncover those historical fragments that show how scientific uncertainty and political necessity moved politicians toward compulsory pasteurisation laws, and show how the capacity to reconfigure milk as an inherently dangerous food allowed this ideational nexus between science and technology to become the ideational rationality of future public policy. Methodologically, it means decomposing those entrenched recollections by analysing those constitutive moments through which current ideational regime is formed (Rose, 1999, p. 194). Ideational regimes are those rationalities, assumed meanings, and conceptual devices used to explain and organise reality. It represents a particular "stratum of knowing and acting: that create the "conditions of possibility and intelligibility": used for coordinating efforts to protect the public from BTB[4] and other milk-borne infection (Rose, 1999, p. 19). It operates across political boundaries as a non-local constellation of ideas focused on interpreting their relations between milk, germs, and bodies, while recommending the supporting technologies

[4] *Mycobacterium tuberculosis* (MTB) was the bacterium first identified by Koch in 1882 and later recognised as the human strain of tuberculosis usually affecting the pulmonary (respiratory) systems of the body. After 1898, Smith identified a bovine strain—*mycobacterium bovis* (BTB)—which typically manifested as a non-pulmonary form of the disease in the abdomen.

needed for action. These ideas not only inform local practices as interpreter of experience and guide for action, these localized circumstances also continually inform and help reproduce or transform the ideational regime.

Two historical moments help cut through the complexity surrounding the transformation of milk from a food source, that under certain conditions became a vehicle for disease-causing pathogens, to an inherently dangerous food requiring specific forms of intervention justified by the reification of the germ theory as unassailable science. The first occurs in July 1901 at the British Congress on Tuberculosis, when it became apparent that scientific theorising about the causal nature of germs in human illness had ground to a theoretical standstill from which it has yet to recover. The second occurs in October 1938, when Ontario's provincial government institutionalised a permanent policy of avoiding exposure from any bacteria found in milk by relying on the technologies of pasteurisation. This legislative act formalised the ideational lens through which all future thinking would frame milk. Pasteurisation, as a short-term precautionary intervention, was superseded by the view that pasteurisation was necessary to make milk safe—justified by emphasising the notion of nutritional equivalency (the idea that there are only minimal nutritional differences between unpasteurized and pasteurized milk). A genealogical exploration of these two moments provides some insight into how bacteria became the singular cause of illness and into the conditions that led to targeting milk as the main site of intervention instead of treating individual bodies. By revisiting these moments of historic uncertainty, this essay may contribute to efforts to open up discursive space for alternative approaches to milk safety in the present.

In attending to these issues, this paper does not enter into debates about the philosophical possibilities of epistemological and ontological certainty. There is no Archimedean point from

which epistemological rationalities can determine truths about the world or provide ontological insight into the 'nature' of things beyond their relational statuses within a social world (Hacking, 2002). The very work of reconciling theories with the conditions in which they arise is ''to insert history into the objects of scientific knowledge'' (Rose, 1998, p. 155). History is at once a method and an object of analysis (Scott, 1999, p. 3). I use history as a method for analysing how the etiological and pathogenic uncertainty surrounding germ theory was reconfigured as certainty, while simultaneously analysing how the privileging of particular histories set the stage for making knowledge claims about objectivity and value-neutrality, providing evidence that scientific knowledge is an historical product. Therefore, I reject the desire to bracket science as a special form of knowledge distinct from socially formed perceptions. Scientific explanations are indistinguishable and inseparable from their objects of study, and there are no compelling arguments that demark the place where the social ends and science begins or vice versa (Hacking, 2002) (Rorty, 1999) (Woolgar, 1988). The important task is to examine how our concepts and practices, derived from experience, constitute the relationships between germs, milk, and human illness, and then provide authority and legitimacy within institutionalized frameworks.

Scientific certainty could not have been the main reason for the shift to pasteurisation because the successful application of pasteurisation technologies could not justify a belief in germ theory. The theory could not explain the randomness of infections, determine the virulence of different strains of TB, and was incapable of determining the degrees of interactivity between different bacteria within bodies. Nor could the development of pasteurisation technologies or tuberculin-testing techniques overcome these theoretical limitations. The observation that BTB were present in cases of human illness and associated with the consumption of milk is not the

same as saying that they were the singular cause of human illness. Appeals to singular causes led to the subjugation of more complex narratives about the experience of illness associated with infected milk, leading to narratives about progress and commensurability in scientific knowledge. This process of displacing uncertainty came about by organising beliefs about milk through a theoretical-technological mode of thought stripped of the contested, contradictory, negotiated circumstances in which it arose in an effort to make the representations of knowledge claims appear objective and value-neutral (Knorr-Cetina, 2005, p. 122) (Woolgar, 1988). These processes of inscribing objectivity and value-neutrality onto bacteria created the pretext that scientists were gaining insight into the ontological nature of milk-borne diseases, instead of recognising that scientists were engaged in a claims-making process of 'ontologizing' certainty from uncertainty. Despite this practice of creating ontological statuses of certainty, the empirical evidence remained inconclusive and did not support claims about the nature of bacteria or their causal routes in the onset of BTB or other milk-borne diseases. The adaptation and adoption of ideational rationalities within the scientific community and the broader social context depends upon the transformation of ideational rationalities from uncertainty to certainty as a way to govern. The employment of knowledge claims becomes a central activity of government mediated by expertise that aid in the administration of conduct (Miller & Rose, 2008, p. 55). Ideational rationalities constitute reality through experts, and when their claims are unpacked a multiplicity of intersecting histories become visible that suggest a much more complex set of circumstances explaining the movement to compulsory pasteurisation laws. The mechanisms for privileging knowledge claims within ideational regimes reveals (1) how knowledge claims emerge from uncertainty within ideational regimes and (2) resulted in unintended, but necessary biopolitical outcomes.

**Ideas matter: Ideational regimes and biopolitics**

Since the 19th century, scientific knowledge has become a productive force for change and a pivotal constitutive element in how organisations and practices organise (Bohme & Stehr, 1986). This is particularly true of laboratory work, which has become one of the primary mechanisms of power (Latour, 1983). After the 1870s, laboratories in Britain were becoming ideal sites for administrative and commercial interests because it was in the laboratory that health issues were reduced to quantifiable abstractions that allowed for the standardisation of diagnoses and treatments (Sturdy & Cooter, 1998). These attempts to oversee the health of populations through statistical means were widespread and growing throughout the 19th century because it made the political management of populations administratively possible and predictable (Hacking, 1981) (Johansson, 2003) (Rose, 1999, p. 197 ff.) (Rusnock, 2002). Counting, metrics, and processes of quantification become the medium through which experts fabricate scientific explanations to be used as 'regimes of intelligibility' that organise the way people (and politicians) think and act in the world (Rose, 1999, p. 28). Moreover, as knowledge becomes institutionalised, ideational constraints emerge and place limits on what scientific research is undertaken in the future, particularly once politicians, medical professionals, and business leaders settle into a mode of thinking and begin to exclude those seeking to rethink the existing modalities (Grundmann & Stehr, 2000). It is this capacity to quantify, operationalise, and institutionalise ideas that create the conditions through which the world becomes more intelligible and governable.

The question then becomes 'how do some ideas become privileged while others dismissed or ignored'? Somers and Block (2005) have captured this process in their notion of an ideational regime. In their view, ideas have the power to independently influence the goals and regulations

of political institutions and this happens because some ideas have more value than others (p. 265). Those with value become privileged and then become ideationally embedded within existing institutional arrangements to form new ideational regimes. These ideas achieve ‘‘epistemic privilege’’ because they have ‘‘the causal power to undermine, dislodge, and replace a previously dominant ideational regime’’ and in that role display an ‘‘astonishing immunity to the kinds of empirical challenges that should be evidentially disconfirming’’ (p. 265). Some ideas have an explanatory power that is disproportionate to its capacity to explain reality because ‘‘epistemically privileged ideas come equipped with their own internal claims to veracity’’ (p. 265). That is, the ‘‘ideational contender’’ must address an existing crisis by redefining reality with an alternative explanation, which must in the first place identify the ‘‘cause’’ of the problem and then, as a part of that causal explanation, provide a possible solution. The success of germ theory lies in its assertion that disease-causing pathogens cause human illness and that the removal of these pathogens will prevent illness. The theory not only attributes a causal explanation, it also has within it an obvious and actionable solution—namely, the elimination of those disease-causing pathogens.

The problem with germ theory is that it cannot explain the larger empirical reality that most people do not become ill when exposed to these disease-causing pathogens—precisely because there is no isomorphic relationship between the presence of disease-causing pathogens in milk and the incidence of illness, and yet it remains the privileged ideational rationality. Some circumstance must prevent this theory from being displaced. While ideas are an essential component in constituting an ideational regime, I argue they are insufficient for determining how the privileging of some ideas occurs. A theory can only have ideational value when coupled with ‘‘implementable’’ administrative and technological solutions. States cannot take up an idea and

use it to organise the formal structures of a state institution without the administrative and technological capacity to implement policy. Only an ideational-technological nexus can act as a *dispositif* resulting in a privileged mode of thinking.

The power of germ theory to maintain its status as the privileged discourse lies not in its access to the causal complexity of illness from tuberculosis, but in the capacity of engineers to develop technologies that operationalise theories at the level of the population. While pasteurisation technologies could be employed successfully as a preventative strategy for avoiding exposure to disease-causing pathogens, these successes could not justify a belief that germ theory was representative of reality. The use of technologies does not prove the truth of the theory from which it was derived; it only demonstrates that germ theory provided a practical avenue for action (Bunge, 1966; Mulkay, 2005). In which case, an ideational regime only emerges when ideas, technologies, normative considerations, and market rationalities result in the conditions for the possibility of fabricating an ideational mode of thought that is actionable.

The emergence of biopower in the 17th century was not just a political problem of governance arising from the loss of a centralised sovereign power (Foucault, 1990, p. 135). Biopolitical activity is, to some degree, a consequence of relying on science to make policy due to its inherent uncertainty. The process of privileging an ideational mode of thought determines the approach governments will take in aligning individual and state interests. The ideational regime configures uncertainty about the pathogenesis of disease—and, consequently, the use of pasteurisation technologies—to create representations of certainty at the level of the population. Governments likewise create representations of certainty by employing preventative measures that optimize the life of a population (p. 139). In this case, they do so by blocking a range of previous attitudes and practices surrounding milk. It becomes a trace that links particular types of

knowledge claims with the disciplinary powers of the state in ways that allow it to govern at a distance through the networks of force that it authorises (Rose, 1999, pp. 53, 209 ff.). The ideational regime operates to produce schemas of simple causal relations that actors use to constitute a particular vision of reality by finding the administrative and technological means to act. Scientific inquiry conceptualises reality in limited ways using causal explanations, numbers and statistical probabilities, which are typically over-determined representations that do not capture the complexity of everyday material circumstances.

**1901 British Congress on Tuberculosis: Normalizing germ theory**

In 1901, Charles Chapin was a public health official in the state of Rhode Island. He worked tirelessly to put an end to the persistent scientific belief that contagions emanating from decaying matter cause illness—the filth theory of contagious disease. His work did not represent a precise moment when one mode of thinking displaced another. Rather, it was a representative moment in a long transition resulting in the acceptance of germ theory. It had taken decades, building on the work of Henle (1840),[5] Pasteur (1862) and Koch (1882), to become the privileged explanation of how contagious diseases spread so that health officials could begin targeting germs and work toward improving the health of populations (Latour, 1988).

The number of clinical and public health laboratories mushroomed in an effort to understand the implications of these events. Clinical laboratories focused on theoretical-experimental issues expanding the lexicon of identifications and classifications whereas health laboratories focused on improving the techniques for and eliminating pathogens from the environment. This led to the professionalization of public health workers (Vernon, 1990). The

[5] Jacob Henle was the first to theorize germ theory in an essay called ‘‘On Miasmata and Contagia’’ in 1840 (Winslow, 1943, p. 296).

capacity to eliminate germs through these emerging networks of public health practitioners and institutions shifted the clinical focus from identifying and treating illnesses within specific bodies to a new form of surveillance medicine that targets the entire population as perpetually at risk from drinking milk (Armstrong, 1995). Chapin's voice was just one among many representing the momentum of this transition. He wrote:

> It will make no demonstrable difference in a city's mortality whether its streets are clean or not, whether it has a plumbing law. [. . .] We can rest assured that however spick and span may be the streets, and however the policeman's badge is polished, as long as there is found the boor careless with his expectoration, and the doctor who cannot tell a case of sapolio from one of diphtheria, the latter disease, and tuberculosis as well, will continue to claim their victims. [. . .] Instead of an indiscriminate attack on dirt, we must learn the nature and mode of transmission of each infection, and must discover its most vulnerable point of attack. [. . .] The great problem of sanitation today is how to deal with milk or unrecognized cases of contagious disease and with those persons who, though well, are yet infected. This problem is not likely to be solved so long as physicians trace infection to the class of things mentioned, instead of the persons (Chapin qtd. in Winslow, 1943, p. 365).

His view reveals two important issues that need further examination. First, he equates germs as the cause of disease with the practical goals of preventive practices. By his thinking, if we eliminate germs, we will eliminate disease, and justify a belief in germ theory. However, the issue of causality between germs and disease were deeply dividing research scientists at the time of his comments. Germ theory could not explain the obvious: that most people did not become ill when exposed to the same disease-causing pathogens. Second, identifying milk as the mode of transmission for BTB and other diseases represents milk as an inherently dangerous food that

requires scientific intervention to make it safe. These two issues, the causal efficacy of germs and the need to target and regulate the modes of transmission of disease using germ theory, affirmed for Chapin a growing conviction that the efficient application of germ theory to purifying milk would re-establish normality by eliminating the pathological (Canguilhem, 1991, pp. 42-43). This conviction over-determined the role of germs within a complex network of biosocial relations. Indeed, it makes germs the focal point through which to secure public safety by claiming to have knowledge of a specific aetiology requiring the implementation of pastoral techniques that control the purity of milk.

Chapin in his enthusiasm overstates the role of germs. Scientists had to construct germs as the cause of illness because their epistemological and ontological statuses could not be determined solely through passive observation. Certainty, for them, arose by actively theorising the causal relationships between germs and illness organised through complex networks of meaning and material experiences. This is not a new problem. There has always been a problem reconciling scientific explanations with their objects of study. This problem has been widely acknowledged (Fleck, 1979; Foucault, 1989a, 1989b; Hacking, 2002; Knorr-Cetina, 1983, 2005; Latour, 1983, 1987, 1988; Latour & Woolgar, 1986; Mulkay, 2005; Polanyi, 1958; Woolgar, 1988). Few would dispute the fact that we observe entities we call bacteria that in some instances, and under certain types of conditions, are pathogenic and have a negative impact on the functioning of individual human bodies. However, to what degree is our relationship to germs a social construction? For Woolgar (1988), there are no objects beyond discourse and the ‘‘[f]acts and objects in the world are inescapably textual constructions’’ (p. 73). Hacking calls pathogens an ‘‘indifferent kind’’ that do not interact with our social-scientific notions of them (Hacking, 2002, p. 104 ff.). Inherent in the ‘‘discovery’’ and naming of bacteria is not some

explanation about our relationship to those entities. Their activities are indifferent to our understanding of them.

The observation of autonomous physical entities and the scientific processes of theorising their causal relationships within a complex biosocial world are distinct events. As objects of scientific study, the specific characteristics attributed to bacteria that give them specific roles within the social world ‘‘is the consequence of scientific work rather than its cause’’ (Latour & Woolgar, 1986, p. 182). Scientific activity does not have special access into the nature of reality that operates outside the existing norms and values of social relations (Woolgar, 1988). In addition, once it became evident that laboratories could make visible the germs that were contributing to human infections from BTB, laboratories became a powerful new social form that thrust to the foreground the necessity of deferring to experts (Latour, 1983). Beyond the observation of bacteria, all those subsequent accepted-acceptable ‘‘facts’’ about the relationships between germs, milk, and illness emerge out of historically specific modes of thinking about how bodies become ill that would in turn become generalised expressions of certainty.

Scientists gave germs a priori status by treating them as part of a concept-independent reality uninfluenced by our perceptions of them. The processes of ontologizing the attributes researchers read onto scientific objects of study come from our experiences of those connections and only give the appearance of objectivity and value-neutrality. Statements like ‘germs are the cause of disease’ became a factual, objective statement used as a political strategy to undermine and depoliticize counter arguments by fabricating milk as an ‘inherently’ dangerous food in need of scientific intervention. In practice, researchers can only theorise bacteria as the cause of

disease retroductively and abductively by examining their consequences in the world.[6] Individual scientists working within disciplinary boundaries contribute to this process of ontologizing uncertainty. Scientific facts are given their reality by organising ideas via a particular ‘‘style of thought’’ that exerts itself on the conscious and subconscious minds of scientists (Fleck, 1979, p. 41). This eventually gets organised as a ‘‘thought collective’’ that so constrain its participants that deviance from the privileged ideational forms within that collective becomes a virtual impossibility (1979, pp. 38ff. 99). This is akin to Foucault’s (1980) notion of a ‘regime of truth’ through which knowledge claims are conditioned by a mode of thinking that shape how and what information becomes true (p. 197). These regimes become the discursive fields in which scientific theorising occur, but occurs as a recursive operation where the already existing beliefs about the causes of infection and the modes of transmission constrain future thinking about

[6] Retroduction ‘‘is a mode of inference by which theories are developed in reverse, by reasoning from a problem to a proposed explanation . . . it is the only way in which to discover the existence of nonempirical things’’ (Marsden, 1999, p. 17). Abductive reasoning comes from the work of C. S. Peirce (Misak, 2004) and is formulated as: if A, then B can explain B; therefore, probably A. This formal concept of abduction is a syllogistic inference with logical import, but it does not have the power of the deductive-nomothetic model of reasoning, but nor is it laboured with the inherent epistemological problems of deductive and inductive reasoning. Abductive reasoning in its less formal form is the methodological practice of reconceptualising and recontextualising social contexts (Danermark, Ekstrom, Jakobsen & Karlsson, 2002, p. 89ff.). It can take the form of genealogical excavations. When the social scientist says ‘we are re-connecting the dots as a challenge to the dominant views’ this is done by appealing to historical evidence that has been newly discovered or for whatever reason been suppressed, marginalised, or ignored; it is not an arbitrary excavation of the past to support an agenda in the present. It does not assert truth, merely reasonable probability of an explanation being truer based on the evidence. Increasing accuracy, not truth, is the role of abduction. It tells us what might be the case in the light of new evidence.

preventing infections from BTB. Past findings become future assumptions and, in a sense, made the movement toward compulsory pasteurisation laws an ideational inevitability for those medical practitioners and researchers who had already come to the conclusion that technological successes could make up for theoretical inadequacies.

What observation confirms about BTB is that they are a necessary condition present in all cases of the disease, but not the singular cause. The ontologizing process reconfigures BTB as the singular cause deducible from a set of nomothetic projections about their ontological status that becomes the basis of a positivistic account of germs as disease-causing agents. This transpositional process gives the impression that scientific theories are objective because they closely mirror some 'out-there' reality. This happens in part when researchers try to strengthen their claims by formulating clear, declarative propositions that remove uncertainty. Once the qualifying modalizers ('it may be the case that A . . .' or 'if we assume this about A, then sometimes B . . .' etc.), those nuances and/or qualitative uncertainties, have been removed from a statement, objectivity is presumed (Latour, 1983). However, even this process presumes an underlying ethical dimension through which the decision-making process operates. The relationships between germs, milk, and illness could only be assessed qualitatively from within the discursive situation, which presupposes what Smith (1990) calls a normative order—a set of beliefs, values and norms—that function as a ''schema of interpretation'' that determines what counts as accurate representations of reality (p. 86). Law and Williams (1982) found that scientists take a deliberative approach to ensuring their work 'makes sense' within their particular scientific fields by organising facts and observations in accordance with the context of existing thinking. The proper references and associations are made with the 'right' people and they stylistically and grammatically groom their presentations and papers to be acceptable to

other scientists. So even though conference presentations, journal articles and collegial interaction are the discursive fields where scientific discourses are contested by various experts, those discourses still must fall within an accepted and non-verbalized range of ideas which, when transgressed, lead to the fragmentation of thought and association within and between experts. In others words, germs move from being causally-involved within a complex socio-physical environment of multifarious causes to the singular cause resulting in a deductive-nomothetic account of illness. In the end, it all gives the impression that germ theory provides an ontological account of illness (Canguilhem, 1991, p. 40).

Koch was similarly embedded within these types of discursive fields, and this made his famous assertion at the July 1901 British Congress on Tuberculosis—that infections from BTB were a rare event—such a problem. Koch (1901) wrote: ‘‘the important question whether man is susceptible to BTB at all is not yet absolutely decided, and will not admit of absolute decision to-day or to-morrow, one is nevertheless already at liberty to say that, if such a susceptibility really exists, the infection of human beings is but a very rare occurrence’’ (p. 191). He was struggling to reconcile his widely believed theoretical position about pathogenic causality and the contested empirical reality that not everyone becomes ill when exposed to those same pathogens. He had not yet been willing to let go of the uncertainty that was still showing up in experimental situations. So, while Chapin was making his case in favour of germ theory because it was a practical means of preventing illness, Koch, one of its main progenitors, vacillated between certainty and uncertainty about the precise role BTB was playing as the cause of disease in human beings. BTB was a particular concern because it passed through the milk of tubercular cattle, whereas other diseases found in milk were the result of contamination after milking due to poor hygiene and sanitation standards throughout the production and distribution processes

(Barry, 2009; Pickard, 1997). While Koch had identified MTB as the ‘‘cause’’ of tuberculosis in human beings, it was 1898 before Smith observed there were bovine and human strains of the disease. Although, he sensibly concluded that his initial observations were not conclusive and that these differences raised more questions about the virulence and interactivity of these two strains and would require further study (T. Smith, 1898). More importantly, the ability to distinguish between strains would not add to the existing repertoire of germ-controlling techniques or shed any more light on the underlying causality of disease in the human body. Instead, these findings would only add to a growing catalogue of associations between germ and symptoms.

Animal experiments, attempting to demonstrate the transmissibility and virulence of BTB, were ongoing but inconclusive. Koch’s efforts to induce BTB in healthy animals had failed, suggesting healthy organisms were not susceptible to disease. It also demonstrated, once again, the importance of hygiene and sanitary conditions in combating disease and that tubercular pathogens could not be the singular cause of human illness (Montizambert, 1901). He also found that milk coming from tubercular cows was not dangerous unless there were also tubercular lesions on the udder. Ernst (1889), in response to Koch, demonstrated the opposite. Even when the udder was not infected, milk from these cows could induce illness in 50 percent of the cases. However, illness only occurred where pathogens were injected directly into the bloodstreams of rabbits and guinea pigs, which species were known to be more susceptible to tubercular infections (p. 11). What these types of experiments demonstrate are the problems of non-standardized research designs, practices, and the inability to distinguish readily between tubercular strains. These experiments consistently lead to contradictory findings and only make uncertainty certain. Ironically, it would be the standardization and routinization of laboratory

practices seeking to falsify and verify experimental outcomes that would further create the conditions of artificiality where laboratory practices no longer reflect the complexities of the biosocial world. For example, part of making experiments repeatable was to increase the potency of the pathogen by isolating it from its environmental context (Latour, 1983). Yet Ernst still found that, even under controlled conditions, only 50 percent of the laboratory animals became ill. This is still a problem today, and there is often uncertainty about the virulence of BTB in human beings. The interaction between MTB and BTB strains still make it difficult to assess causes and makes diagnosis difficult (Grange, 2001). As an outcome, animal experiments did not tell experimenters much about the conditions for transmissibility, explain the randomness of infections, nor establish degrees of virulence.

What convinced Koch (1901) that BTB was a rare event was the autopsy evidence. Citing the case of 3104 autopsies performed at the Charité Hospital in Berlin, Koch reported they found BTB and MTB strains were simultaneously presenting themselves in the children autopsied. There were no cases of BTB without the presence of MTB, and BTB could only be said to be the primary cause of infection in 16 of those cases (Koch, 1901). The ability to distinguish between BTB and MTB only complicated their understanding of virulence and interactivity. Koch was not alone here. Other presenters at Congress agreed that the evidence of BTB infections in ‘‘children was rather scanty’’ (Maxwell, 1901, p. 314). It was a conundrum. Clinical experiments had not resolved the issue. While there was clearly evidence BTB crossed the species barrier and infected humans, empirically it seemed a rare event.

Koch’s presentation incited anger and frustration because it undermined the uncontested medical opinion that TB infections passed easily between the species and caused disease (Delepine, 1911; Montizambert, 1901). As a result, much of the subsequent science focused on

trying to prove Koch wrong (Atkins, 2000, p. 38). By the time of the Congress, many American and British doctors and medical researchers had already accepted pasteurisation technologies as confirmation of their theoretical stance and the solution to the problem of BTB (Jones, 2004) (Montizambert, 1901). They were also increasingly active in campaigns for safe milk (Rosenkrantz, 1985), and in some instances, Koch's position was thought to have re-focused efforts to institutionalize pasteurisation (Barnett, 2000, p. 69). Nevertheless, the question of virulence remained. Smith's findings simply added another discursive dimension. Were people becoming ill from MTB, BTB, or a combination of both? Wilson (1942) reports that even decades after Koch's remarks there was no diagnostic techniques capable of distinguishing between MTB and BTB except through a bacteriological analysis. These analyses were done only in a small number of cases. Therefore, the aetiology of the vast majority of cases of TB remained unknown (Burks, 1911; Wilson, 1942, p. 22). Nevertheless, Koch's statement gave ''rise to serious administrative difficulties'' because governments were seeking to prevent the distribution of tubercular milk and it was becoming increasingly clear that public health officials ''could not afford to wait for the results of slow experiments'' before acting (Montizambert, 1901, pp. 313, 214; also Delepine, 1911, p. 547). Collectively, through voting, the persistence of discourses appealing to the successes of intervening at the level of the germ using pasteurisation technologies, and procedural processes, the Congress resolved that milk carrying the BTB stain was still a threat until further evidence could show with certainty that BTB was not the health threat it was now widely believed to be. These theoretical uncertainties re-emerged at the 1908 American Congress on Tuberculosis, but this time Koch stood virtually alone in his assertions (Rosenkrantz, 1985). That same year, Chicago enacted compulsory pasteurisation laws and Toronto's Hospital for Sick Children began pasteurising all milk for its patients.

The Conference demonstrated two things: First, medical practitioners and researchers were aware that germs were only one causal element and by themselves could not explain either the randomness of infection nor the degree to which MTB and BTB were interacting. The same lack of explanation was also true regarding the virulence of the strains. Germ theory was too reductionist, but not without reason. Germs were, and remain, the only necessary condition that was, and is, amenable to the processes of quantification because they exist as identifiable, discrete entities external to the physiological functioning of the body. Koch's postulates[7] do not determine 'cause' so much as they operate to make quantifiable those necessary conditions which, when subjected to the processes of ontologizing uncertainty, reconfigure germs as the ''singular'' cause. Second, medical theorising would have to continue to transcend the body specific and organise itself as an authoritative form of intervention through a multitude of germ-controlling techniques (Foucault, 2004). Their inability to ''know'' the causal mechanisms of disease forced scientists to remap disease outside the body, and begin statistically modelling the risks of MTB and BTB at the level of populations. In this case, Canguilhem (as found in Sinding 2007) observes patients are rendered invisible and ''no longer the subject of her or his disease''. Instead, the patient becomes ''an example of the universal'' (p. 269). In locating disease outside the body, medical practice inverts the processes of diagnosis. Bodily symptoms become cues

[7] Causality was determined using Koch's postulates: ''(1) the parasite occurs in every case of the disease. (2) The parasite does not occur in other diseases or nonpathogenically. (3) After being fully isolated and repeatedly grown in pure culture the parasite can induce the disease by being introduced into a healthy animal'' (Barnes, 2000, p. 433). Because these criteria were verifiable and reproducible, they became the ''gold standard'' for laboratory researchers wanting to make claims about a particular bacterium as the ''direct'' or ''singular'' cause of disease.

through which medical practitioners read back onto the body its illness in accordance with the authorised ideational rationality. Scientific uncertainty made governance an exercise in aligning individual safety with pathogenic-free forms of milk. When Koch asserted infections from BTB were a rare event it was because the empirical data was still contested and inconclusive. The ‘‘scant evidence’’ could not justify the negative response Koch received for his remarks. Expert opinion was determining etiological certainty, not scientific precision. Scientists were inferring from the successes of germ-controlling techniques that they had an empirical justification for a belief in a germ theory. This conflation of explanation with application occurred precisely because the capacity to model causality within complex biosocial environments was limited, and within bodies non-existent. Germ theory was an incomplete representation, and delegates were justifying their rejection of Koch based on the efficient and efficacious intervention of technologies, specifically tuberculin testing of dairy cows and pasteurisation technologies.

**1938 Institutional surrender: foreclosing on future possibilities**

The British Congress on Tuberculosis in July 1901 was a landmark date because it became apparent that germ theory could no longer move the debate in any one direction. The uncertainty inherent in germ theory meant policymakers could not rely wholly on a particular scientific account, so the discourse shifted from curative issues to strategies of prevention that would become an end in itself. The concerns of government were much broader than the concerns of experimental scientists seeking to confirm or disconfirm germ theory. What made germ theory so useful was its utility. It made targeted public policy possible, and formalised ‘‘microbe-hunting’’ as the institutionalized rationality between the years 1880 and 1940 creating a ‘culture of microbe-phobia’ (Lederberg, 2000). Not only must governments act in the face of uncertainty, it is also an expectation of the governed. Subsequently, the generation of public policy is one of the main activities of government (Steinmetz, 1993), where the process of abstracting policy from

complex sets of conditions is neither easy nor entirely satisfactory. In the case of milk, governments needed to choose from a range of possibilities—the conditions for the production of affordable, safe milk.

On 1 October 1938, Ontario's legislature under the leadership of Liberal Premier Mitchell Hepburn enacted an amendment to the province's *Public Health Act* making pasteurisation compulsory throughout the province. The amendment made the sale of unpasteurised milk for public consumption illegal, making it the ''first electoral area of its size in the world to make pasteurisation compulsory'' (Berry, 1941, p. 209), and would set the stage for future national and state legislation in Britain and the United States shortly after WWII.[8] It replaced the existing Milk and Cream Act of 1913, which allowed Ontario's municipalities to exercise local control over the production and distribution of milk within their communities. Before 1938, only 50 of the more than 800 municipalities in Ontario had enacted some form of mandatory pasteurisation. It was likely no coincidence that the amendment of the Public Health Act in 1938 followed on the heels of a resolution made by the *Canadian Medical Association* in June 1937 that supported universal compulsory pasteurisation laws.[9] At the same time, the newly formed *Canadian Council on Nutrition* established caloric standards to be used in managing relief for the poor and establishing unemployment benefits after 1940 (Ostry, 2006, p. 105ff.). Continuing problems of infected milk and public demand for affordable safe milk sees the Ideational linkages between

[8] Because of the rise in all forms of TB during the war, in part attributed to the wartime transfer of city children to rural towns to protect them from air raids over Britain's large cities. Many of these children became ill and raised public ire and concern about their children's safety (Bryder, 1988, p. 246).

[9] *Canadian Public Health Journal*, 1938, vol. 29, p. 269.

germ theory, nutritional sciences, and pasteurisation technologies become an indispensable resource of government. Emerging ideational networks began operating as *inferential networks of knowledge* drawing inferences and integrating a range of scientific theories, technologies, political manoeuvrings, and economic imperatives that were coalescing as a singular ideational rationality justified and organised through the notion of nutritional equivalency. This notion authorised the implementation of compulsory pasteurisation laws that satisfied a range of interests. Once enacted, efforts to supply safe unpasteurised milk would no longer be the concern of government, the medical community or the dairy industry as each focused on reorganising their interests around pasteurised milk in the name of public safety.

This single legislative Act formally acknowledged the existing ideational regime and its commitment to pasteurisation as the only technology sufficient for managing both the public's nutritional health and safety. We are told they were part of an effort to enhance the province's ability to enforce safety standards equally throughout the province, to standardise the techniques and equipment used to pasteurise milk, to make safety standards enforceable, and to implement the widespread view that pasteurisation was the only effective means of making milk safe for consumption (Berry, 1941). Resulting in the 1941 claim that 92 percent of Ontario's milk was pasteurised (Bryder, 1988, p. 247).[10] This differed significantly from the view of Canada's Food Controller, who, some twenty years earlier in 1917, was recommending two grades of milk be made available for consumption: one unpasteurised from approved tubercular-free herds and the

[10] This seems a strong claim given in the same year 93 percent of the milk sold in the city of London was pasteurised. That percentage drops dramatically to less than 10 percent in areas surrounding boroughs. No county in Britain was pasteurising more than 50 percent of their milk, and in small towns and the countryside access to pasteurised milk was virtually non-existent (Bryder, 1988, p. 138).

other pasteurised (Hanna, 1917). Medical professionals and milk activists widely believed that unpasteurised milk was a healthier choice and should not be adulterated unnecessarily (Ehlers, 1937; Krauss, Erb, & Washburn, 1933; Montizambert, 1901; Phillips & French, 1999; Straus, 1977; Wilson, 1942). This tension between healthy and less healthy forms of milk complicated relationships between dairy producers, government, the sciences, activists, and the public. The penchant for treating infected milk as a municipal problem, the unavailability of effective pasteurisation technologies (Jenkins, 1926; Savage, 1933; Shrader, 1925), the unwillingness of the courts to prosecute cases involving ‘‘dirty’’ milk throughout this period (Wright & Huck, 2002), and the rise of infant formulas as legitimate substitutes for milk (Levenstein, 1983) contributed to a complex social environment. None of these suggested a clear path for government intervention that would alter their reliance on eradication programmes as the principal response to BTB infections. Until pasteurisation technologies were more effective and had little or no impact on the nutritional qualities of milk, government policy was only secondarily concerned with efforts to make pasteurisation compulsory.

**Alternatives to pasteurisation**

The problem with the alternatives to pasteurisation, however, was that they were administratively intense and could not guarantee the safety of milk. Henry Coit (1854-1917) founded the *Medical Milk Commission* to provide certified clean unpasteurised milk to New Jersey in 1894 (Levenstein, 2003, p. 139). Securing the necessary administrative oversight to enforce hygiene standards throughout the production and distribution processes was nearly an impossible task of managing large-scale sets of complex relations driven by conflicting interests (Wasserman, 1972). In addition, certified milk simply cost too much, and it was often double the price of untreated milk (Levenstein, 1983). Alternatively, pasteurisation technologies localised a

specific site for intervention, making it a precursor for effective action (Canguilhem, 1991, p. 39). Propasteurisers like Nathan Straus (1848-1931) were having enormous success establishing milk depots that either boiled or pasteurised milk. He had been strongly urging the government since the 1890s to implement the pasteurisation of all milk in the United States as a necessary precautionary step, and it was his persistence that led New York to implement city-wide compulsory pasteurisation laws in 1914 (J. Miller, 1993). Access to milk that was either pasteurised or derived from tuberculin-tested herds was an essential interim strategy until control over the ‘‘conditions’’ was established (Straus, 1977, p. 272). Straus argued that compulsory pasteurisation laws were a scientifically justified policy.

The alternative to preventative strategies of managing infected milk at the points of consumption was the equally problematic attempts to manage the complex conditions of animal and farm hygiene at the sites of production. Nevertheless, eradication programs became a ubiquitous strategy after Koch’s 1890 development of a tuberculin testing method for identifying tubercular infected animals. Tuberculosis was endemic in European and North American cattle, ranging from approximately 10 percent in the United States in 1915 and up to 80 percent in parts of Europe (Olmstead & Rhode, 2004). Numbers are less forthcoming in Canada, but the Canadian Government reports by 1898 that BTB infections were ‘‘rapidly decreasing’’ and that they were thoroughly committed to the slaughter of infected cattle as the most practical method of minimising the risk of BTB infections (McEachran, 1900, pp. 107, 124). There is little doubt that eradication programs were the most effective strategies for preventing BTB infections throughout the early decades of the 20th century, long before pasteurisation could solve the problem (Crossley, 1970). Slaughtering tubercular cattle had been enormously successful in the United States, but was expensive and required intense administrative effort in policing individual

dairy producers (Olmstead & Rhode, 2004). Nevertheless, it effectively reduced the percentage of infected cattle to less than 0.5 percent of the total population by 1940 (Bryder, 1988, p. 134). The British experience was somewhat different. A 1931 estimate by the Ministry of Health stated that while 40 percent of the cattle were infected with BTB, less than 2 percent of these animals passed BTB through their milk.

One major problem in attempting to reduce the BTB load in public milk sources was structural in that milk from infected cows was often bulked together with uninfected milk and subsequently became infected (Bryder, 1988, p. 137). This problem remains with us today. The risk of all milk-borne infections increases in urban milk supplies when milk is pooled from many sources (Grange, 2001). The ‘‘new’’ crisis in milk was that milk produced under a model of mass-production increases the risk of contamination after milking. Eradication programmes, no matter how successful they were in eliminating BTB from cows, could not ensure a safe milk supply free from contamination from poor after-milking practices (Wilson, 1942, p. 56). Milk-borne diseases such as diphtheria, scarlet fever, typhoid were common in milk and links between milk and outbreaks of scarlet fever and typhoid were known since the 1880s (MacDougall, 1990, p. 98). Subsequently, there was a demand by many to only consume milk derived from tuberculin tested cows that was also then pasteurised (BMJ, 1935; Shrader, 1925). Only pasteurisation could further reduce the risk of exposure to disease-causing pathogens, and perhaps close the door on the problem of infected milk altogether, and that move depended largely on the ideational change being driven by the nutritional sciences.

**Nutritional equivalency**

Despite the social complexity of the interwar period, nutritional scientists would stand out as crucial biopolitical actors because only they could legitimately resolve the issue of whether

there were significant nutritional differences between pasteurised and unpasteurised milk. Milk could not convincingly remain an essential food for health unless it could be shown that it was unaffected by the processes of pasteurisation. Since the first milk depots appeared in New York in 1892, medical professionals widely believed that boiling or pasteurising milk made it ‘‘less nutritious and indigestible’’ (Montizambert, 1901, p. 40). While they were deeply divided about these issues, they also saw it as an unavoidable technique providing safe milk for the public (New York Times, 1903). At the leading edge of this debate were a new cadre of nutritional experts, who made their debut during the 1850s in Germany and Holland directing the ‘‘masses’’ to improve their health through cleanliness and nutrition (Mennell, Murcott, & van Otterloo, 1992). Throughout the 19th century, it was becoming apparent that miasmas and later germs could not give an account of many illnesses. Scurvy, beriberi, pellagra and rickets, for example, had no bacterial cause but were a consequence of nutritional deficiencies. As the nature of these deficiencies became more apparent, nutritionists began interpreting the population’s health through their access to the nutritive components of milk—intensifying the need for scientific intervention (Rettger, 1917; Turner, 1982). What began as a part of a generalised approach to healthier living modelled after the hygiene movements of Europe and North America became a means of intervening in the production and distribution of milk for that sake of the broader political goal of sustaining the health of populations.

Experimental data measuring height and weight differentials between groups of children drinking unpasteurised milk versus those drinking pasteurised milk was the primary empirical evidence in support of nutritional equivalency (Frank et al., 1932; Rettger, 1917). In 1931, in an effort to quell the diversity of opinion about the value of pasteurisation, the British Ministry of Health reiterated its 1923 claim that pasteurisation had no impact on milk’s nutritive values

because studies had shown there were no detectable differences in height or weight between cohorts consuming pasteurised milk versus unpasteurised milk (Bryder, 1988, p. 136; Stenhouse, 1931). This 1931 report continued to ignore ongoing experiments with contradicting findings (Stenhouse, 1931). Medical researchers continued to reject the Ministry's claims, and were critical of the largest study of this kind—a study of 20,000 children in Scotland over a four month period—because the data was inconclusive (Krauss et al., 1933). These types of studies could not give a precise account of what caused or did not cause changes in height and weight.

The problems of research designs limited to measuring changes in height and weight in children over short periods is a problematic methodological issue. Researchers must have assumed that populations had fixed rates of growth that are easily manipulated, that these populations have similar diets that similarly impact an individual's growth, and that these children had similar immunological function with no other underlying conditions. Nevertheless, these were representative of the kind of experiments done at the time. More importantly, populations were being remapped as ''calculable spaces'' (Rose, 1999, p. 213) and as extensions of laboratory rationalities where people's health was remade in light of nutritional knowledge (Latour, 1983). Nutritional experts were generating new patterns of interaction and projecting onto milk a new set of standardized, quantifiable perceptions that made its theories actionable. Medical opinion remained divided throughout this period, however, and continued to support the position that grade ''A'' (unpasteurised) milk from tuberculin-tested cows should be sold alongside pasteurised milk until the data proved more conclusive (Watson, Watson, & Sutherland, 1938). This division counts as a strong reason for the ambivalence of governments to change regulatory directions during the interwar period.

As information about the vitamin and mineral content of milk became available, especially after the 1930s, the focus shifted to analysing the effects pasteurisation techniques had on the nutritional components of milk. The transition to this completely reductionist approach to nutrition had first solidified after 1906. Identification of some other ill-defined 'food factors', described as ''vitamines'', were theorised as contributing to health, although seen as different from the recognized macronutrients of fats, carbohydrates, and proteins (R. Smith, 2009). In this model, the consumption of nutrients in their elemental forms equals health, and remains the model for today's institutionalised nutritionists (Hoffmann, 2003). Researchers had little insight into how enzymes, haemoglobins, proteins, fats, minerals and vitamins—all of which are destroyed, damaged and/or altered to some degree during the pasteurisation process—interact as complex foods within the complex environments of bodies. The willingness of scientists to quantify milk's nutritional components is the same process of ontologizing uncertainty that allowed nutritionists to make scientific claims about the nutritional nature of milk. These types of studies would consistently show there were only small declines in calcium, phosphate, and vitamin A, while the significant declines only effected vitamins B1 and C (BMJ, 1933; Frank, 1934; Krauss et al., 1933). Overall, the effects of pasteurisation on enzymes, the milks bactericidal properties (which in part prevent milk from putrefying), antibodies, and lactic acid ''have been dismissed as irrelevant''. So long as consumers of pasteurised milk supplement their diet with citrus fruits and cod-liver oil there was no reason to reject consuming pasteurized milk (BMJ, 1933, p. 792).

While nutritional equivalency was an important axis for political action it, too, was intersected by concerns about affordability and safety. Malnutrition was on the rise after WWI in urban centres like Toronto and New York and governments responded by promoting milk

consumption (MacDougall, 1990, p. 204). It was the least expensive protein that could feed large numbers of people (Hanna, 1917) and was grounded in the scientific view that there was ‘‘no difference between a beefsteak, a pork chop and the curd of milk’’ (Chapin, 1907, p. 194). It was more than a coincidence that milk consumption, which had peaked in 1909, began to recover in the 1920s because of the intervention of nutritionists and the promotion of its nutritional content (Levenstein, 2003, p. 155). The healthy population would now be organised by using milk to manage the levels of vitamin and mineral across whole populations. This rationality was on display when the USDA published its first food guide in 1916 and made milk its own food group. While it would be well into the 1930s before there was a significant grasp of the nutritive makeup of milk and the effects pasteurisation would have on those components, conceptualising milk in this way signified a wholesale conversion from the idea of drinking wholesome, clean, unadulterated milk to drinking ‘‘safe’’ milk containing the appropriate levels of vitamins and minerals. Nutritional equivalency became the ideational template that would render pasteurisation technologies an invisible intervention because its impact on milk was negligible.

The application of this template was an inescapably gendered process affecting women and the poor disproportionately. The consumption of nutritious and safe milk, was tied to cleanliness, to motherhood, to domestic ‘‘purity’’ and social order (Block, 2005; Ostry, 2006; Valverde, 1991). Starting in the 1920s, the dairy industry began vigorously promoting milk consumption not just for infants, but for the health of everyone (Levenstein, 2003, p. 154). Medical practitioners co-opted mothers to act as their interlocutors to preserve the family’s diet and health recommending women use milk formulas and consume pasteurised milk (Ostry, 2006, p. 50ff.). This also normalised the view that the infant-feeding practices of women needed medical intervention and management (Levenstein, 1983; Nadesan & Sotirin, 1998). The most obvious

and perhaps extreme example were maternal milking stations, which were established in numerous cities across Canada and the US beginning in 1921 (Laws & Skelley, 1938) with the sole purpose of pasteurising breast milk on the ideational rationality of nutritional equivalency and maternal safety.

The local and regional distribution of affordable, safe milk was a major public concern in the 1930s (Guard, 2010). Poor women were particularly vulnerable to the vagaries of contaminated milk because of their inability to either lactate and/or their inability to afford safe milk (Ostry, Shannon, Dubois, & Nathoo, 2003). The problem for many was that certified clean milk and pasteurised milk were more expensive than was generally available (Levenstein, 1993, p. 59; Ostry, 2006, pp. 46-47, 114). Certainly, Chicago's health commissioner, William Evans, had observed this same problem and ranks it as one of the strongest influences in Chicago's early transition to compulsory pasteurisation laws (Czaplicki, 2007). An important 1937 study analysing the relationship between health and income found a strong correlation between low levels of income and lower rates of milk consumption, noting that the availability of affordable milk could close this nutritional gap and raise the levels of nutritional health among the poor (Boyd-Orr, 1937). The role of milk was further entrenched as it was widely believed that Canadians in general were most deficient in calcium (McHenry, 1941). In 1941, Canada's first *Official Food Rules* formalised a long-standing recommendation of drinking one pint of milk per day for children and half a pint for adults. There was also observed the emergence of strident women's movements in large urban centres in the 1930s, which were educating people about the benefits of drinking milk that needed to be affordable and safe (BMJ, 1935; Guard, 2010; Hucks, 1941). While political activism was crucial in pushing governments to act, nutritional

equivalency gave governments a convincing route for responding to those concerns that was unavailable until the late 1930s.

**Ideational rationalities manifest through market forms**

The interwar period was a time of ideational gestation, when the ongoing processes of quantifying our relationships to milk made it amenable to commercialization, a necessary condition for action in complex societies (Rose, 1999, pp. 206, 211). Policymaking is essentially a definitional activity, and the power to define milk in terms of its nutritive components alone, along with the capacity to reduce illness to germs, meant the mass production of milk by commercial interests could be justified in light of securing the nutritional needs of the public (Kjaernes, 1995, pp. 271-272). Markets offer technologies routes through which ideational regimes can operationalize its privileged rationalities. The over-riding concern for the medical community from 1870 onwards was the transition toward greater efficiency and organising in accordance with national and corporate interests. The emergence of the laboratory became a focal point for this transition, as it was a practical way for administrators to manage knowledge claims while at the same time acting as an entry point for businesses seeking to commercialise laboratory findings (Sturdy & Cooter, 1998). This was possible because laboratories are those sites that sifted knowledge of all its qualitative implications, and then used those ‘‘objective, value-neutral findings’’ to constitute a new reality where scientific explanations and commercial interests are harmonised. Once infections from milk were remapped extracorporeally as quantifiable statuses throughout populations they were suitably co-configured for integration into markets forms.

The quantification of social life has helped determine the types of laws and regulations that society adopts (Hacking, 1981). The ideational forms guiding the regulation of milk converged

with economic interests. Both the scientist and economist employ reductionist approaches to divide reality into discrete and manageable portions in their efforts to control, regulate, and profit from milk. This did not occur all at once, but over time, as medical professionals and activists sought a clean milk supply. Large dairy producers were pressured into seeing the financial benefits of providing a standardised, safe product using pasteurisation technologies (Sheldon, 1909; Wilson, 1942, p. 57). Milk Commissions that began operating in 1892 to oversee producers and distributors would only increase and intensify over time, and through their efforts forced milk distributors to use refrigeration technologies by the 1930s (MacDougall, 1990, pp. 100, 106; Savage, 1933). But things as simple as the invention of refillable milk bottles in 1884, and automated filling and capping machines in 1886, would eventually become ubiquitous by the 1930s (Manchester, 1983, p. 95), making possible the commercial distribution of safer milk to large urban populations. Pasteurisation served as a tactic countering the social consequences of industrialisation and urbanisation on the health and living standards of the working poor. Poor living conditions and unscrupulous milk producers and distributors delivering adulterated and contaminated milk were leading to a crisis in urban centres (Atkins, 1992). However, even competent suppliers had difficulty getting fresh milk into urban centres. As attitudes to pasteurisation changed, the dairy industry underwent a complete transformation, restructuring and reorganising to take advantage of new technologies, like electricity, refrigeration, sealed bottles, as well as new methods of mass transportation and the expansion of the transportation infrastructure.

A biopolitics can only come to fruition when it is fused with market forms (Larsen, 2007; Nadesan, 2008, p. 182). Rather than markets acting as limits to government intervention, markets become technologies regulating subjectivities and constituting new realities (Larsen, 2007). The

decades-long crisis of infectious milk does not then reflect the emergence of a new form of biopolitics. Biopower was already organising social life since the mid-eighteenth century (Foucault, 2003, p. 242). Pasteurisation technologies are but a new instance of it. They were developed and integrated into an existing biopolitical context that embraced a ‘‘specific kind of economic rationality’’ and meant that efforts to protect people from the dangers of milk would have to be configured through the dominant social form, namely markets (Larsen, 2007). The problem of governing the biology of a population as a scientific object was coordinated with the profit imperative of economics from the outset. The emergence of compulsory pasteurisation laws and the development of pasteurisation technologies did not originate with a sovereign act of the state in response to a particular health crisis. Rather, the management of those populations required governments to organise around a science-based ideational regime made visible through inferential networks that pieced together a set of ‘‘implementable’’ rationalities suitable to the existing economic form.

Policymakers actively seek scientific explanations to support regulatory reforms and to redirect business while maintaining market imperatives (Bullen, Fahey, & Kenway, 2006) (Larsen, 2007; Nadesan, 2008). Profitability depends on producing durable goods that can be traded over greater distances (Friedmann, 1994, p. 272). Pasteurisation makes it possible to mass-produce milk at lower costs. It extends the shelf life of milk by killing all bacteria, good or bad, and destroying enzyme activity. Milk is no longer a ‘‘live’’ food under these circumstances, and in this denatured form, the expansion of mass produced commercial milk is possible, justified by fulfilling the narrow nutritional needs of the public established by nutritionists. Once institutionalised, compulsory pasteurisation laws became an end in itself. Debates about temperatures and duration became the central focus of research and the problems of commercial

pasteurisation were difficult to solve at the time. Commercially pasteurised milk often had more bacterial content than unpasteurised tuberculin tested grade ‘‘A’’ milk and was attributable to poor pasteurisation practices, inadequate equipment, and the risk of recontamination after the pasteurisation process (Jenkins, 1926; Meanwell, 1927; Rettger, 1917; Shrader, 1925). Milk remained a dangerous food until the technologies and practices were standardised and made enforceable by the 1938 Act. The good became to pasteurize all milk rather than pursue a deeper understanding about how the various pathogens found in milk made individuals ill or controlled through alternative methods. The 1938 Act simply institutionalised a regime that, once accepted, becomes a problem of mastering pasteurising techniques, not revisiting the histories of how milk became inscribed as a site for intervention.

**Conclusion**

The power of science to maintain its status within the ideational regime was twofold and did not lie in its access to certainty, but in its capacity to define, classify, categorise reality and, secondly, in its ability to provide actionable solutions. Nineteenth century developments in the new sciences of bacteriology and microbiology inspired a shift in the mode of thinking about the relationship between disease and health allowing the reduction of all experience to the constraints of a single dominant cause. A germ theory of disease over-determined the relationship between germs and illness that made political action possible. It is nearly ubiquitous. The claim is that scientific discovery and the application of scientific theories contributed directly to the elimination of infectious diseases at the turn of the 20th century (Mulkay, 2005, p. 104). The claim is true and untrue at the same time. What new theories, like the germ theory of disease, eliminated were future cases of disease by controlling the mode of transmission in which disease-causing pathogens thrived. What is not true is that the germ theory of disease was capable of demonstrating the direct cause(s) of human illness. The success of pasteurisation

technologies in the prevention of future illness could not justify or confirm a belief in the germ theory of disease.

Pasteurisation as a political technology becomes an entrenched practice, not because it solves the theoretical problems inherent in germ theory, but because the known inadequacies can be controlled for. Technologies like pasteurisation can actually ‘‘slow down the advancement of science’’ (Bunge, 1966, p. 346). What is still in question is the degree to which specific germs interact in their environments and how to identify and measure specific environmental factors, and then attribute risk. The calculation of risk is always a socially mediated construction. Today’s molecular epidemiology may be much more sophisticated and able to identify more pathogens and their relationships to their environment which, in turn, may make more specific methods of controlling infectious diseases possible (Barnes, 2000). The processes of quantification have the capacity to settle disputes in those contested spaces where there is uncertainty by using rhetorical techniques to subjugate alternatives (Rose, 1999). Even still, simply expanding the lexicon of identified bacteria does not get us past the inadequacies of germ theory or make certain the inferences drawn across ideational fields. Nevertheless, the political calculation becomes obvious in light of the theoretical-empirical stalemate of the 1901 Congress. Pasteurisation technologies, germ theory, and nutritional equivalency allowed milk to be configured as nutritious, safe, and affordable, and all of this made the 1938 Act economically, politically, and socially useful. It also formalised a biopolitical outcome that, perhaps unintentionally, committed governments to managing the well-being of whole populations by pasteurising milk and monitoring nutritional statuses, putting individuals in the position of learning to manage their own health by following the advice of nutritional guidelines and complying with compulsory pasteurisation laws.

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**THIRD PAPER**

# Raw Milk Activism and the State:

# Discursive Clashes Around Nutrition and Safety

**Abstract**

The raw milk lifestyle has been gaining momentum in Canada and the United States over the last two decades. Raw milk activists resemble what Haenfler, Johnson, and Jones (2012) have described as a lifestyle movement organised around some shared beliefs that identify what constitutes a healthy lifestyle. How science informs the activities of activists is a neglected area of study (Jamison, 2006), including the role scientific discourses have in framing those activities. In this paper, my understanding of discourse analysis is informed by Foucault's work in *The Archaeology of Knowledge* (1989). However, I use Luke (2002) to focus my analysis of some of the statements made by state actors working within the propasteurisation state as well as some of the statements made by raw milk activists that are published in texts either online or in print. I use Luke to see what these texts "do" at the macropolitical level to transform knowledge regimes and relations of power in political and social environments. Each side uses published scientific studies as both a line of communication through which to speak to each other and as a technique for producing convincing, "science-based" narratives that organise and justify each side's views of health, nutrition, safety, choice, and thresholds of risk. My intent here is not to evaluate the veracity of the scientific claims deployed by either side. Rather, the focus is on describing the role science plays as a disciplinary technology, which is then in turn resisted by activists who deploy alternative scientific studies to support their lifestyle choices. I use Deleuze and Guatarri's (1987) notions of royal (institutionalised, bureaucratic) and nomadic (activist) science found in their nomadology (pp. 351–423) as discursive entities to represent different domains of thought. These discursive entities can be used to investigate how activists and propasteurisers contest milk as nutritious and safe in ways that validate their contrasting points of view. The emphasis, however, is on the activists' statements because of their marginal social location

within the discursive landscape. Their marginal position as simply a lifestyle choice helps to illustrate the dominant position that science takes as a disciplinary technology.

*Keywords*: Discourse analysis, enzymes, lifestyle movements, nomads, pasteurisation, raw milk, risk, Weston A. Price Foundation

> Isn't it curious that at this juncture in our culture's evolution, we collectively believe Twinkies, Lucky Charms and Coca-Cola are safe foods, but compost-grown organic tomatoes and raw milk are not? (Salatin, as quoted in Gumpert, 2009b, p. x)

The raw milk movement has been gaining momentum in Canada and the United States over the last two decades, but surprisingly little analysis has been published in academic journals about how raw milk activists have been advancing their opposition to state propasteurisation policies using a science-based approach to influence legal–political change. As a form of resistance it most closely resembles what Haenfler, Johnson, and Jones (2012) have called a lifestyle movement and is primarily organised around an identity. Drinking raw milk is largely an individual project, and as a movement "encourage[s] individualised participation in the private sphere rather than collective action in the public sphere" (Haenfler et al., 2012, p. 12). It is the way people choose to live their lives that becomes the primary means through which social change is manifested, and is generally not organised through the efforts of any one organisation. Not all raw milk drinkers are activists, but they may use the information provided by other more active raw milk proponents to inform their lifestyle choices. Mark McAffee of Organic Pastures in Fresno, California, is arguably the most recognizable face of this type of movement because of his very visible legal battles with the Californian government, particularly in recent years as he has tried to bring changes to California's testing standards used to determine the safety of milk.

Nevertheless, Haenfler et al. (2012) have claimed some organisation is essential, even in a lifestyle movement, as a means of disseminating information. Some raw milk activists have adopted that role and are disseminating information about raw milk as a means to defend their lifestyle. The Weston A. Price Foundation (WAPF) is an example of this type of response. After

Sally Fallon Morell became aware of Weston A. Price's book *Nutrition and Physical Degeneration* (1939) in the 1970s and used his dietary recommendations to improve her family's health (Black, 2008), she co-founded WAPF with nutritionist and lipids researcher Mary Enig in 1999. The organisation operates out of Washington, DC, and has since become an important raw milk advocate attempting to systemically organise and centralise a program of resistance through the organisation's website, public meetings and publications. This is consistent with the desire of raw milk drinkers to protect their way of life. Whatever coherence exists within this movement as a whole is predominantly organising around common discourses about what constitutes a healthy lifestyle, the role of government, individual rights, sustainable agriculture, and protecting cultural assets such as the family farm. These are common themes arising in alternative food movements and are often motivated by the failures of conventional food systems (Zerbe, 2010). Examples of these attitudes can be seen in documentaries such as *Farmageddon* (Canty, 2011), *Food Inc.* (Kenner et al., 2009) and the *Raw Milk Crusader* (Wood & Lofts, 2008), where, through a number of interviews, the viewer is introduced to the struggles of individuals as they are confronted by state–corporate power. This disciplinary form of power is seen not only to punish through its legal systems but also to adopt a pastoral role through which it works to realign activists' beliefs with state-sanctioned points of view.

I have found two main underlying discourses that organise the debates around milk. One is about the nutritional values used to understand milk and the other is about the safety of raw milk compared to pasteurised milk. These two discourses are omnipresent in texts by and about the raw milk lifestyle such as documentaries, online material, and formative books such as *The Untold Story of Milk* written by raw milk activist Schmid (2003). Moreover, these materials represent efforts to contest official discourses on the ground of science (West, 2008). They raise

questions about how the existing science gets used by state actors and activists to debate whether raw milk is more nutritious than pasteurised milk and whether raw milk is as safe as or safer than pasteurised milk. Activists reflect a particular type of discourse that rejects the state's science–legislative position that there are no health benefits to drinking raw milk and that it is too risky and therefore legal access should be restricted. I have focused on these two discourses because they seem to me to order the other discourses that circulate around milk about political choice, individual rights to govern their bodies, access to the marketplace, protecting the family farm, and health. That is, without convincingly arguing that pasteurisation is safe and more nutritious than pasteurised milk these other discourses lose their impetus, at least in so much as activists organise their resistance around milk. Legitimizing the production of raw milk using science may relocalize milk consumption and production and open up non-corporatized spaces where the independent family farm can carve out a niche in the marketplace. To protect their way of life, activists are resisting the state's propasteurising position by entering the discursive spaces within the scientific literature where there are competing views about how to legitimately interpret these two issues. The activist does this by critiquing the state's choice of scientific studies and by presenting alternative studies that come from medical and science journals. The activist also critiques the research designs and methodologies of studies that get cited by propasteurisers. WAPF's (2014b) website page titled "Key Documents" has many documents created by the organisation and are examples of this strategy. In the *Risk as a Way of Configuring Raw and Pasteurised Milks* section, I provide an example below of how these tactics are deployed.

The role of science in social movements and the role of social movements in science, technology, and society studies are, according to Jamison (2006), neglected areas of study, even though science since the 1960s and 1970s has increasingly been used to coordinate and organise

economic, political, and social relations. The view that social movements have since become alternative sites "for the constitution and reconstitution of the scientific enterprise" is neglected (Jamison, 2006, p. 56). Through their activities, new sets of assumptions are employed in an effort to recalibrate the organisational and technological criteria deployed by the state to legitimize its activity. Social movements should be analysed not just as organisations responding to state dominance but as legitimate producers of knowledge capable of contributing to policy (Chesters & Brem-Wilson, 2010). In the debates around raw milk, scientific statements operate as both a line of communication and as a technique for producing convincing "science-based" narratives used to organise and justify each side's views of health, nutrition, safety, choice, and thresholds of risk. To emphasise how this discursive space is being contested, I used the distinction Deleuze and Guatarri (1987) made between royal and nomadic science as a heuristic device for clarifying and differentiating the statements each side makes about nutrition and safety to affirm their views of milk.

My intent is not to evaluate the veracity of the scientific claims deployed by either side. Rather, the focus is on the role science is playing in activists' efforts to promote this lifestyle and how the state uses science as a disciplinary technology to marginalise activist claims. What became apparent as I studied this activity is just how asymmetrical this power struggle between activists and the state is in terms of access to scientific resources, state research apparatuses, and levers of political power; yet such a small number of people have been able to win some legal battles that protect their right to drink raw milk. This struggle is organised around discourses, which Luke (2002) points out may be studied via in-depth analyses that focuses primarily on the formation of texts and/or via macro analyses of how texts are employed and deployed in socio-political contexts. Subsequently, one pathway for doing discourse analysis is to emphasise what

texts “do” at the macro level for the people who use them in their struggles to bring about change (p. 102). I use Luke to show how the discourses of nutrition and safety get used by activists and propasteurisers to (re)configure milk. This discursive activity reveals the relations of power that exist between royal and nomadic sciences as they struggle to solidify and validate their views on the nutritional value and safety of drinking raw milk.

In this paper I move through a number of sections that describe and analyse this struggle. Section one introduces the government position on milk. Section two then introduces the raw milk activist as a noncompliant actor. Section three explains how I have organised my analysis of the two sides using Deleuze and Guatarri’s (1987) notions of royal and nomadic science as discursive fields and how this nomadology framework is useful in analysing how milk is variously produced as healthy, nutritious, and safe. Section four positions the activity of royal and nomadic science within a neoliberal context where the institutionalisation of state–corporate interests legitimize and standardise a particular form of commercial milk production that creates the conditions for suppressing local, raw milk production. From within this state–corporate dominated context, section five examines how activists push back at this dominance by arguing raw milk as nutritionally superior. I use the example of enzymes to focus this discussion. Finally, section six provides another example of this resistance by looking at the issue of public safety and milk. Throughout, but particularly in sections five and six, I use texts published either online or in print by individual activists and activist groups as primary sources to provide some insight into what raw milk activists are arguing in their attempt to resist the state’s compulsory pasteurisation laws. I do this by focusing on the central discourses activists have deployed to defend their lifestyle by using the existing science as a discursive space for contesting how milk is produced as nutritious and safe.

**Pasteurisation Policy as State Sanctioned and Contentious**

Canada and the United States both have federal policies enforcing the pasteurisation of milk. Health officials, particularly those voices coming through the Centers for Disease Control and Prevention (CDC) and its Canadian counterpart, The Centre for Infectious Disease Prevention and Control (CIDPC), continue to caution policymakers and the public about the variety of diseases transmitted through unpasteurised milk that are best managed by expanding, strengthening, and standardising policies that prevent its consumption. Across Canada milk is regulated by the *Food and Drugs Act* and specifically by the *Food and Drug Regulations* (Section B.08.002.02s), which prohibits the distribution and sale of unpasteurised milk for consumption by the public. Similarly, the Department of Health and Human Services in the United States is an agency of the U.S. Food and Drug Administration (FDA) that regulates the interstate trade of milk via *The Grade A Pasteurized Milk Ordinance*. In it, Section 9 also prohibits the distribution and sale of unpasteurised milk to the public.

Unlike Canada, where provinces must comply with federal law (Weir, Mitchell, Reballato, & Fortuna, 2007), individual state assemblies have sole jurisdiction over health matters. This has resulted in some states banning the distribution of unpasteurised milk to the public while others have allowed it. The policies used to control how the production, distribution, and sale of milk are regulated and policed vary from state to state. Currently, only 10 states allow for retail sales, and another 15 allow for direct sales from farmer to consumer—the remainder have weak laws or no laws, or have made it illegal to sell raw milk (WAPF, 2014d). Health officials in both countries have said there are no additional health benefits gained from drinking unpasteurised milk and that it continues to pose a "significant public health risk" (Canadian Press, 2014, para. 4). Murray McQuigge (2006), a Canadian public health officer, reflected the official view of the CDC and CIDPC in dramatic fashion:

> Cow's milk is not safe when it comes straight from the udder. These diseases [he mentions tuberculosis, brucellosis, listeria, salmonellosis, E. coli (O157:H7), campylobacter gastroenteritis, and staph and strep infections] are all passed through the cow and into its milk. No amount of clean animal husbandry can prevent this. . . . To bring in legislation to allow the sale and distribution of raw milk would be tantamount to manslaughter and taking Ontario back to the Dark Ages. (para. 8, 15)

Food policies developed by governments as a form of intervention have been a contentious issue throughout the 20th century (Lang & Heasman, 2004). Drawing on the European experience, Lang (2004, p. 21) has argued that food policies are now so bound up with corporate interests and ownership of the supply systems that policymakers are invariably led to produce regulations that organise around two goals that now operate globally. On the one hand, industry pressures governments to standardise food production in ways that create, improve, and promote cost-effective, efficient food supply chains while simultaneously working to secure the trust and well-being of the public on the other. While these goals are not inherently contradictory, these different agendas open up discursive space that invites discussion and public concern about how standards and safety are defined and regulated.

Contemporary compulsory pasteurisation laws are a manifestation of this type of activity that had its beginnings during the interwar period. Nutritional scientists at the time were claiming the nutritional differences between pasteurised and unpasteurised milk were insignificant; therefore, drinking unpasteurised milk was not worth risking the variety of infections borne by milk (Speake, 2011). This line of reasoning still persists and is used by state authorities to deny the public legal access to raw milk (Barry, 2009; FDA, 2006; Jay-Russell, 2010; Leedom, 2006; Sheehan, 2005). Activists reject this view. They argue that the differences are significant and that

consuming raw milk is much healthier and is not as dangerous as the CDC and CIDPC would have the public believe.

**Raw Milk Activists as Noncompliant Actors**

Raw milk activism is not just about having access to raw milk. It is part of a larger movement resisting agribusiness and the loss of food diversity. Generally, these movements are demanding access to clean, organic, and non-GMO foods. Within this context, the legal right to access raw milk has become another of those nexuses for reclaiming food rights. Raw milk activists are about relocalising food production and regaining control over the food supply. Raw milk activist Salatin (2009) reflected this view when he wrote that the public's trust has been jeopardised because of the collusion between state regulators and large agro-corporations that alter and manipulate foods using science as a disciplinary technique to dispossess citizens of their right to make informed choices outside of corporate–state interests (p. xi). All this activity is organised around discourses. Salatin's statement reflects some of the discourses circulating among raw milk activists about corporate manipulation, corporate power, state collusion, choice, democracy, freedom, purity, rights, ideas about health, and control over their bodies and life circumstances. Activists stress that they want to reconnect to environmentally friendlier and less chemically dependent modes of production and redemocratise food choices (Fallon & Enig, 2001; Planck, 2006; Schmid, 2003; WAPF, 2011). As nomadic challengers to royal power, activists are trying to engage the state on its own terms: namely through science. Corporate and state power are susceptible to alternative scientific challenges because both use science as way to assert their own dominance over raw milk activists. Activists are trying to redemocratize individual choice by reconfiguring existing discourses about what it means for a food to be nutritious and what food safety looks like when milk is produced under different, non-industrial circumstances. In recent years, raw milk activists have been using the Internet to reinvigorate the

issues of pasteurization and food rights. They use it to actively promote the consumption of raw milk and challenge corporate–state regulation of the milk supply.

It is difficult to measure how widespread this lifestyle choice has become and sales remain small where it is legal; however, the demand is reportedly growing (Barry, 2009; Drape, 2007, August 8; Labes, 2008, January 18; Madden, 2008, February 23; Tryon, 2002, December 18). One indicator is the growing number of dairies selling raw milk. In the last five years, the number of raw milk dairies has doubled in Massachusetts and trebled in Washington, even though the overall number of dairies in those states, but also nationally, is declining (M. Johnson, 2008). Their presence is contested, however. In January 2010, the Massachusetts Department of Agricultural Resources again proposed a ban on the sale of raw milk, citing CDC figures (discussed in the last section) showing that raw milk is too dangerous for public consumption (Landau, 2010; see also Gilbert, 2010). In Pennsylvania the numbers of raw milk dairies are more impressive, growing from 26 in 2002 to 153 in 2013 (Rowan, 2013). The Canadian website NaturalMilk.org (2005) has estimated that about one percent of the population, or roughly 250,000 Canadians, consume raw milk regularly. This approximates the 1.5 percent of Americans found to consume raw milk in a survey carried out by the CDC (as cited in The Natural Milk Coalition of Canada, 2003).

A 2002 CDC national survey put the number even higher, finding that 3.5 percent of respondents had consumed unpasteurised milk within the last seven days (Barry, 2009; LeJeune & Rajala-Schultz, 2009). Dairy producers are three times more likely to drink raw milk than the general population (Jayarao et al., 2006). Young et al. (2010) have estimated about 90 percent of Canadian dairy producers consume raw milk. Cole (2007) reported at least 100,000 Californians drink raw milk every week. A slightly older study showed that sales receipts from unpasteurised

milk amounted to less than one percent in the 28 states where it was legal (Headrick et al., 1998). WAPF has put the number of raw milk drinkers at around 500,000 (Drape, 2007, August 8), but newer numbers from a CDC survey done in 2007 suggest about three percent of the United States' population (about nine million citizens) drink raw milk (Hartke, 2012). Monroe (2009), blogging on the Farm-to-Consumer Legal Defense Fund (FTCLDF), did not give an estimate of the number of raw milk drinkers but instead suggested that "after illegal drugs, raw milk . . . may be the most briskly traded underground commodity in America" (para. 4).

The distribution and consumption of raw milk remains a small but persistent social phenomenon whether sold legally (in some states) or illegally through underground networks as is the case in Canada and parts of the United States. Yet, this phenomenon illuminates the discursive grounds upon which food, health, nutrition and safety is being contested. Science is used by both royal and nomadic actors as a productive force that organises and solidifies particular types of strategies as a way for achieving discursive dominance. How texts get used plays a key role in this process. There are numerous studies in peer-reviewed journals that are used differently to support contrasting points of view. It is often not clear how certain texts get chosen by activists and propasteurisers except that their choices reflect the different discursive predispositions that have been validated within royal and nomadic science. In that sense, scientists and activists are not neutral actors but actively producing different claims that configure milk differently as nutritious and safe. I provide an example of how each discourse is taken up and contested.

WAPF claims to provide unbiased information about health and nutrition (Fallon & Enig, 2001). Its mission, according to its website, is the "scientific validation" (WAPF, 2015, para. 5) of its views, and the website has an impressive collection of articles and rebuttals, almost all

citing peer-reviewed academic journals and government agencies, defending the health, safety, and legal right to choose to drink raw milk. WAPF also publishes a quarterly journal, *Wise Traditions: Food, Farming and the Healing Arts*. Part of its agenda has been the Campaign for Raw Milk, focused on promoting alternative views about the health and safety of milk. The Price-Pottenger Nutrition Foundation (PPNF) has a similar mission to provide "trustworthy, reliable information" (PPNF, 2014, para. 1) about diet and nutrition based on the scientific research of doctors Price and Pottenger that includes the promotion of raw milk consumption as part of a healthy diet. The FTCLDF (2014) is an American, web-based, nonprofit organisation established in 2007 to help consumers and producers litigate their right to access raw milk and other nutrient-dense foods of their choice free from federal, state, or local interference. Mercola.com, operated by Joseph Mercola, DO, is a popular educational website critical of the drug industry and industrial methods of food production. Mercola (2011, 2014) has often promoted the health benefits of drinking raw milk. Other websites, such as *The Bovine*, the *Canadian Consumer Raw Milk Advocacy Group*, and *Raw-Milk-Facts* are blogs that advocate drinking raw milk. Their sites operate independently of one another although they have links to WAPF. In addition, books have been written in support of the raw milk lifestyle, such as Douglass's (2007) *The Raw Truth About Milk*, Gumpert's (2009b) *The Raw Milk Revolution*, Planck's (2006) *Real Food*, and Schmid's (2003) *The Untold Story of Milk*. This activism is not limited to these figures and there are many other websites that use similar discourses about choice and health as a way to promote drinking raw milk.

Drinking raw milk represents a challenge to the state's preventative health paradigm. Proponents are seen as noncompliant actors that historian Valenze (2011) has described as misguided seekers of a "miracle food" (p. 287) that satisfies some unmet yearning to find an

"elixir of immortality" (p. 287). Nutritional researchers Aarnio and Lindeman (2004) have contributed to this view. Their research concluded that many people have mystified beliefs about what constitutes a healthy food. In their analysis, however, to be mystified is to refuse expert nutritional advice. However, these types of analyses are also problematic. Not only do these researchers presume much about the validity of what constitutes nutritional advice, but they also reflect, unintentionally or not, a neoliberal vision of the relationship between the state and the rational individual citizen. Individuals are expected to accept more personal responsibility for their health but must demonstrate that obligation by aligning their lifestyles with state experts while governments increasingly prioritise business interests and withdraw health and oversight services. Neoliberal discourses about privatization, deregulation, and the liberalisation of trade are operationalised through policies that facilitate corporate-government cooperation and result in the marginalisation and subordination of the individual to a role of cooperating with expert authorities. This ordering of social life is organised through discourses circulating within social contexts (Foucault, 1989, *passim*). This ordering effects how people live their lives. Within a neoliberal context, adopting the proper beliefs about health becomes an indicator of the moral commitment that individuals have to live as "healthy citizens" (Petersen and Lupton, 1996, p. 3), which Petersen and Lupton characterise as each person becoming responsible for living a healthy, state-sanctioned lifestyle in accordance with expert advice that uses science coupled with the public's fear of becoming ill as coercive and disciplinary techniques.

**Subordinating Raw Milk Within Bureaucratic Capitalism**

Royal science is a state apparatus that actively produces and solidifies a particular view of milk that is amendable to and aligned with political and business interests. How they relate to one another creates the social conditions through which discourses emerge and engage one another, but also determines their relevancy (Luke, 2002). Foucault's (2003) analysis found that

regimes of "truth" organise around scientific discourses and institutions subsequently form around those discourses to legitimate a particular point of view (pp. 316–318). Those dominant propasteurising discourses support the need for compulsory pasteurisation laws and the use of pasteurisation technologies to facilitate the distribution of milk as corporate commodities that diverge strongly with the activist's desire to locally produce raw milk. Here I rely on the research of other scholars to understand the present economic–political context within which royal and nomadic entities engage each other. Prescriptions to mandate pasteurisation laws by royal science are embedded within regional, national, and global economic practices and now serves as a homogenising force that organises the dairy industry and contributes to the accumulation of wealth (Busch, 2004; Lang, 2004).

Sjoberg (1999) has described the relationships between governments and businesses as form of collusion he has called *bureaucratic capitalism*, which he characterises as an increased prioritization of policies that protect the economic imperative to accumulate wealth. It is a system of reciprocity where the financial wealth generated by economic activity consolidates state power, while the state provides regulatory stability that preserves accumulation (pp. 44-45). How royal science is integrated into these types of institutionalised arrangements leads to the entrenchment of institutional views and practices that get locked in, causing bureaucracies to become increasingly path-dependent entities systemically resistant to change (North, 1990; Pierson, 1993, 2000). Medical institutions are similarly structured and act as a gatekeeper filtering the "types of interests and ideas that enter into political debates" (Hacker, 1998, p. 59).

The stability of this corporate–state oligarchy depends on the formation and preservation of monopolies (Braudel, 1982; Wallerstein, 2001). The trend throughout North America is a decline in the numbers of dairy producers and an increase in the size of dairy operations (Schwarzweller

& Davidson, 2000, p. 6). This is a heavily subsidised system. Some 70 percent of all farm subsidies in Canada go to dairy producers (Stanbury, 2002). It is a heavily regulated industry subject to quotas and access to government licences under the supply management system, where about 80 percent of those licences go to dairy producers in Ontario and Quebec in the service of three large corporate retailers and exporters of milk, namely Saputo, Agropur, and Parmalat (Agriculture and Agri-Food Canada, 2009). Today's dairy industry is a corporate-dominated system of agribusiness using scientifically legitimated industrialised models of production that align product availability and safety with profitability.

Profitability within a market economy depends on producing durable goods that can be traded over long distances. Long-distance trade requires standardised shippable products. This is the current foundation of the global food economy, and therefore, government supports the movement toward the homogenization of food production and diets (Friedmann, 1992, p. 272). Pasteurisation and homogenization are key processes that make the standardization and expansion of trade possible. These processes make it possible to mass produce milk because they extend its shelf life by virtually eliminating all enzyme activity and thereby reducing the possibility of exposure to pathogens (Pereda, Ferragut, Quevedo, Guamis, & Trujillo, 2007; Rankin, Christiansen, Lee, Banavara, & Lopez-Hernandez, 2010). Raw milk has a shelf life of only a few days before it begins to sour and separate. Homogenisation prevents the natural processes of the milk fat separating from the whey, preserves the aesthetics of milk, and allows industry to regulate the percentage of milk fat.

According to Michalski and Januel (2006), the complete effects of homogenization and pasteurisation on human health have not been thoroughly studied and remain controversial. They reported a range of contradictory studies suggesting a link between these two processes and

allergies, atherosclerosis, heart disease, poor assimilation of nutrients, increased difficulties of casein digestion, and types I and II diabetes. In the meantime, what is clear is that pasteurised milk using the traditional high-temperature, short-time method extends the shelf life of milk, and properly stored will last from 14 to 21 days, but these times may be extended up to 90 days using a micro filtering process (Caplan & Barbano, 2013). Typically, milk treated using ultra high temperatures has a shelf life of up to six months without refrigeration. Heat treating milk a second time prior to packaging the milk for retail extends the shelf life even more and is used to ship milk over greater distances (Sepulveda, Góngora-Nieto, Guerrero, & Barbosa-Cánovas, 2005). Despite these controversies, processing milk using heat-treating methods and homogenization makes milk a much more durable and aesthetically appealing commodity.

For local commercial dairy producers, economies of scale, cost-effectiveness, and predictable outputs become paramount for success. Lyson, Guptill, and Gillespie (2000) speak to this need. They write that under the present milk supply system, small, local producers have little chance of economic success. Increased profits are derived from increasing the herd size and reducing labour costs, which means herd size is the dominant concern. Automation and efficiency increase cost-effectiveness by lowering the need for labour. This means introducing scientifically husbanded breeds that produce much larger quantities of milk regardless of their adaptability to local conditions. It means concentrating more animals in smaller spaces, which means grazing animals on pasture is no longer sufficient. Commercial feeds must be introduced and animals confined. This requires investment capital and the extension of credit to buy and maintain dairying technologies (Lyson et al., 2000, pp. 309–323). These processes and restrictions compel dairy producers to become heavily invested personally and institutionally in the ideas and practices that make wealth accumulation possible.

WAPF (2011) has agreed this is the case for commercial dairy producers but made the argument that returning to local, raw milk production is more profitable for the individual producer and would dramatically raise farm incomes for producers not tied to the corporate system: proper land use and rotational grazing practices produce healthier cows and lower feed and veterinary costs, while higher retail prices allow raw milk producers to have higher incomes than commercial producers (slides, 126–131). In the same PowerPoint presentation, WAPF (2011) argued that pasteurisation laws are responsible for a decline in American rural life because pasteurisation laws prevent the production of local, value-added products, and that allows corporations to remove wealth from local economies (slides, 125, 131). The sale of raw milk could revive, in their view, local, rural economies.

The global dairy system, however, is not organised according to this activist view. Rather, milk destined to enter local, national, and international marketplaces must meet what McDonald (2000) called "global–technical standards" (p. 181) developed by western dairy science, which record percentages of milk fat and the presence of bacteria and other contaminants. These practices of defining and monitoring milk quality and safety are filtered through the interests of government institutions and commercial dairies (McDonald, 2000). Royal science is that filter, and it works to align the production and distribution of foods with economic and political interests (Busch, 2004; Dixon & Banwell, 2004; Fischler, 1988). Food policies do not simply regulate the distribution of "naturally occurring" foods, unadulterated and/or unprocessed (Maxwell & Slater, 2004; Tunick, 2009). Rather, healthy foods and bodies are constituted in political spaces tied to economic interests (Rose, 1999, p. 63). To be a healthy citizen is to be productive and not a health liability. In accordance with this type of governance, Ilcan and Phillips (2003) and Busch (2004) have each shown that the standardization of food production is

being pursued using “expert” knowledge to justify how and what foods get produced and what foods get prescribed as healthy and is an example of the alignment between science and the rationalities of bureaucratic capitalism.

Corporations seek to create trust in their products by attaching notions of health to the product through a process of nutritionalization (Dixon & Banwell, 2004). That is, health claims about milk get organised around its nutritional components. These types of claims are in turn supported by endorsements from health and science organisations, and business interests use these endorsements to influence and support a regulatory environment for their products. The informal and formal collaborations between researchers, professional associations, and corporations influence what nutritional claims become authorised and legitimated (Dixon & Banwell, 2004, p. 124). Keough (2002) has also emphasised the central role both private and publicly funded scientific research have in the decision-making processes that lead to public policy. It is the role of science, he wrote, to advise policymakers and provide pathways to produce healthy products that minimise risks to the public.

While politicians may not directly involve themselves in the production of scientific knowledge, scientific research is nevertheless financed by governments that have ideological and economic commitments. Nestle (2002) has written extensively about the interactions between science, government, and business in her book *Food Politics*. Aronson (1984) has also discussed these processes at length. Scientists have an interest in creating research openings for themselves. The process of legitimating nutritional knowledge is a highly politicized process within bureaucratic capitalism. It is territorial, where institutions protect the interests of the scientists (careerism) and the scientific community as a whole, the interests of agribusiness (profit), and the desire of governments to avoid litigation and reduce social service costs. In

effect, the definitional processes of science protect businesses from liability and are an essential process for gaining access to society's monetary resources (Aronson, 1984, p. 13), and for Miller and Rose (2008) this normalisation of expert knowledge opens up avenues for operationalizing government intervention and makes governance possible.

Efforts by raw milk activists to sell raw milk come up against this well-established state–corporate system. In 2006, the FDA began a multistate crackdown on privately owned farms producing raw milk. A FDA spokesperson said of these raids that people "do not have a fundamental right to obtain any food they wish" (Gilbert, 2010, para. 2). WAPF's Campaign for Real Milk (www.realmilk.com) works with the Farm-to-Consumer Legal Defense Fund (www.farmtoconsumer.org); they have since become involved with raising money for the defence of raw milk producers in their cases against state restrictions on the distribution and sale of raw milk.

The Canadian Food Inspection Agency (CFIA) aggressively pursues violators of the law but do not always become aware of these violations until someone gets sick or files a complaint, since in Canada, where the sale of raw milk is illegal, raw milk drinkers and producers operate locally and deliberately out of sight of government officials (Tryon, 2002). Raw milk activist Michael Schmidt of Durham, Ontario, has experienced these types of state pressures, has become a well-known figure in raw milk circles, and is seen as an important challenger to Ontario's pasteurisation laws. The Bovine and Naturalmilk.org are essentially Ontario-based blogs that advocate raw milk consumption, and both blog about Schmidt's attempts to challenge Ontario law and have been documenting his legal activities. The CFIA has criminally charged Schmidt on several occasions and confiscated his property for illegally distributing raw milk to the public (Selick, 2009; Wood & Lofts, 2008). In response, WAPF (2014c) has argued these charges are

not about public safety, since no one has ever reported becoming ill in the 25 years Schmidt has been distributing raw milk. Rather, WAPF claimed these types of crackdowns are about protecting the dairy industry's monopoly over milk "under the guise of promoting the public health" (para. 3).

On January 21, 2010, Judge Koharsky ruled in Schmidt's favour and acknowledged there is a distinction between private and public forms of milk distribution and that Ontarians have the right to "waive the protection of the public health laws" (WAFP 2014e, para. 3) and consume raw milk if it is their choice. Journalist Dunn (2014), reporting for *The Shoreline Beacon,* went on to write that Justice Robert Sharpe has since ruled that raw milk remains a public health hazard and prohibiting people from consuming raw milk does not conflict with Canada's Charter of Rights and Freedoms. There is, he wrote in his opinion, no clear scientific evidence that there are benefits from consuming raw milk and Schmidt's other claim that drinking raw milk is a lifestyle choice has no merit because the Charter does not protect Canadians' right to food choices. This decision limits the capacity of activists to protest government actions and policy. The activist must now contest scientific–government claims by challenging what constitutes expert advice, an asymmetrical battle that activists are ill-equipped to fight because they lack access to the state's scientific apparatuses.

**Raw Milk Activism as Nomadic Encounter with Royal Science**

Discourse Analysis (DA) is primarily concerned with how power is exercised through language and practices. Through the discursive activity of actors, discourses come into being and are contested. Foucault uses discourses in two ways (O'Farrel, 2005). First, discourses are a "way of speaking" and, secondly, discourses informing a single body of knowledge also represent a single discourse (p. 78). For example, there are discourses within science, and science as a body of knowledge is also a singular type of discourse. In both senses, discourses act as

structuring forces that structure speech, thought, and practices operating within and across a variety of discursive fields. These fields subsequently establish the conditions that produce and transform the categories and rules through which bodies of knowledge emerge (Foucault, 1989). Discourses as relations of power are omnipresent as well as productive and repressive. Accordingly, Kendall and Wickham (1999) suggest that DA is always carried out by examining texts in relation to other texts such as books, scholarly articles, newspapers, government documents, as well as formal and informal discussions. The texts are used as a way to understand how discourses contribute to and order domains of thought and subsequent practices (p. 38). This analysis is always contextualised within the broader context of social life.

Social life is ordered through discourses and these discourses produce different organising fields that frame how discursive activity takes place (Foucault, 1989, pp. 30, 34-43). The ordering of discourses reflect attempts by actors at controlling the interpretative processes and the presentation of information in an effort to transform, decompose, and reproduce beliefs. DA is about both the analysis of how statements are produced and an analysis of the particular function statements have configuring discourses within an historical-social context (Foucault, 1989, pp. 90-98). Therefore, I want to use Foucault's DA to examine how discourses reproduce and/or reinforce the metanarrative.

In Luke's view (2002), DA can and should focus more on how texts are deployed on the meso and macro levels to constitute and organise social and political environments. He is reacting to the tendency in Critical Discourse Analysis (a particular methodology derived in part from Foucault's work) to focus on the close, analyses of statements and/or texts. Instead, Luke wants to shift that emphasis to an analysis of how discourses are ordering the social-political contexts of society through the discursive activities of actors. Luke argues that DA should move

beyond its traditional focuses and methods to an examination of how those texts are used as a productive force that can solidify and transform bodies of knowledge and relations of power in social and political environments (p. 106). For him, DA should also emphasise what these texts "do" and include analyses of the "visible practices" that are a consequence of deploying texts (p. 102). Therefore, I examine some of the statements/texts used by propastuerising state actors and raw milk activists as a way to focus on how the discourses of nutrition and safety are configured differently according to the different interests of these sets of actors. I further examine how each side is contesting the other by employing, interpreting, and producing different texts in their efforts to achieve discursive dominance.

Since social life is ordered through discourses that produce different organising fields (Foucault, 1989, pp. 30, 34-43), one way to think about how the propasteurising state and raw milk activists advance their ideas about the nutritional value and safety of raw milk is to appropriate Deleuze and Guatarri's (1987) notions of royal and nomadic science found in their nomadology (pp. 351–423). The nomadology is a treatise elaborating how resistance to state power emerges from the actions of individual nomads, in this case raw milk activists, when they feel oppressed by the coercive strategies of the state. It a macro analysis of how royal and nomadic sciences contest one another. Throughout the nomadology, Deleuze and Guatarri's concept of royal science is used to denote bureaucratic, institutionalised systems of expertise that operate as a part of the centralising, routinizing, standardising hierarchal apparatuses of government. It actively works to appropriate, suppress, or ban the views of the nomad in order to maintain its authority and stability (Deleuze & Guatarri, 1987, p. 362). Nomadic science alternatively is its own discursive field that operates outside of state control, and as such, it acts as an agent of transformation working to reconfigure the institutionalised claims of royal science

(Deleuze & Guatarri, 1987, pp. 357–359). Royal and nomad science do not appeal to different kinds of science: rather, it is key how each side selects and criticises studies from existing science or produces new science to manage differences (Deleuze & Guatarri, 1987, p. 367). I have mapped this division between royal and nomad onto the division between the propasteurising state and the activist-nomad. Each entity acts as a discursive entity that orders the discourses of nutrition and safety differently as way to position itself in the struggle around raw milk. Each entity has its own sets of rules, claims, presuppositions, and tactics for examining and contrasting how these discourses operate differently to configure raw milk in ways that serve each side's competing interests (Luke, 2002). These interests are not only about examining how scientific discourses within science are contested. They also involve some understanding of how those interests operate within the context of bureaucratic capitalism, which is also contributing to the conditions for resisting and reimagining how competing scientific discourses are used to explain our interactions with milk.

Authorised versions of these discourses order royal institutions such as the Canadian Dairy Commission, established in 1966. This state institution acts as an example of royal science. It has been mandated with the task of getting the fairest rates of return for Canadian dairy producers, plays an important role in influencing dairy policy in Canada, and has partnerships with "food science centres, universities and industry associations" (Canadian Dairy Commission, 2013, para. 1). Agriculture and Agri-Food Canada is a science-based government department with research facilities such as the Dairy and Swine Research and Development Centre in Sherbrooke, Quebec, and the Food Research and Development Centre in Saint-Hyacinthe, Quebec, that research how to optimise dairy production and safety. The United States Department of Agriculture (USDA) operates similarly in the United States, but it has two conflicting roles

(Freeman, 2013, p. 1263). First its role is to promote and expand markets for the dairy industry while also promoting consumption and educating the public about the health benefits of drinking milk, which, when Freeman considers the revolving door between industry and public leaders, operates more like a neoliberal privatised corporation rather than a public institution. These types of government apparatuses have established positions that are resistant to change.

The need to pasteurise milk is no longer an internal dispute within these institutions. The theories and methods of these representatives of royal science are firmly codified and follow set procedures that lead to easily, mathematically reproducible outcomes in support of pasteurisation. The producers and users of this type of science get positioned as centres of rationality and the source of reasonableness through which other scientists and policymakers are able to enforce science-based claims, typically by disallowing nonexpert descriptions and explanations (Cook, Pieri, & Robbins, 2004). For Deleuze and Guattari (1987), this authority comes in the form of scientific consensus constituted recursively by iterating and reiterating the accepted theoretical and methodological views (p. 372). As a result, the theoretical and institutional boundaries of science are created by the acceptable judgements of its members and reified through conferences, journals, and the structures of academia (Fujigaki, 1998). The role germs play in the onset of disease is an example of how royal science works and is employed to govern and formulate a political context for policing milk and engaging the public. For example, Paxson (2008) used the term “microbiopolitics” (p. 15) to draw attention to how governments manage the public’s access to raw milk via the accepted scientific views about the dangers microorganisms represent when found in dairy products. Kurtz, Trauger, and Passidomo (2013) similarly found that confiscations of raw milk by state officials rest on an uncritical view of Pasteurian science that results in political–legal action being taken against consumers of raw

milk. What these analyses affirm is that living well means adopting a particular relationship with microbes that is state sanctioned.

Raw milk activists, on the other hand, are itinerant nomads resisting the claims of the propasteurising state. Their challenge is twofold: they work to resist the logic and reification of particular sets of representations about milk and the state's determination to integrate individuals into its belief systems (Melucci, 1989, pp. 55, 170). Nomadic resistance does not operate as a new form of countervailing hegemon constituted to overthrow the dominant hegemon *en masse* in the typical Gramscian sense organised around class. Rather, Day (2005), in writing about how the newest social movements resist state hegemony, has argued political change is a process of destabilisation effectuated by forming affinities across a variety of axes of resistance that chip away at the hegemonic foundations of the state (p. 173). For instance, the FTCLDF has now aligned itself with WAPF. The WAPF home page (http://www.realmilk.com) lists the FTCLDF as one of its campaigns, and WAPF helped the FTCLDF to raise funds at WAPF's Annual 2013 Conference held in Atlanta, GA.

Nomadic activity around milk pasteurisation persists because royal science does not take into account the immediate experiences of drinking raw milk safely, and that becomes an axiomatic starting point for destabilizing the state's normalised views of milk. Drinking raw milk safely destabilises the solidity of the royal science position. To emphasise this point, the testimonials of individuals are provided on websites, such as WAPF's www.realmilk.com, www.raw-milk-facts.com, and www.rawmilkinstitute.net, and in the *Wise Traditions* magazine, in which raw milk drinkers describe improvements in their health. McAffee included in his presentation at the University of Alberta in 2007 his personal testimony about improvements in his health after he started drinking raw milk. These types of reports are considered anecdotal and

become excluded and irrelevant statements rather than starting points for further research or political engagement. This experience of being marginalised by propasteurisers is what motivates some raw milk activists to become advocates and authors in defence of drinking raw milk (see Douglass, 2007; Schmid, 2003). Their criticisms then focus on critiquing and resisting the state's rationalism, its reductionist paradigms, its over-deterministic view of germ theory, its nutritional accounts, and its linking of germ theory to pasteurisation technologies, all of which delegitimise their experience. McAffee (2012) has called the FDA a "military dictatorship" (para. 2) in that in its focus on some pathogens found in milk, it has ignored the benefits of drinking raw milk and ingesting its enzymes and beneficial bacteria that promote health. Pasteurisation, he writes, "has passed its time of usefulness" (McAffee, 2012, para. 3) and does not reflect the reality of producing and distribution raw milk safely.

Beyond anecdotes, the nomad must produce alternative claims about the nutritional value and safety of raw milk because anecdotes are insufficient for countering royal science. They are but one tactic. The nomad's power must also come from challenging the science used by royal science. They do this by amassing counterfactuals and counter instances that expose the limitations of royal science, which for Deleuze and Guattari (1987) means invoking a counter science and not a rejection of science (p. 373). Since activists are limited in their capacity to produce original scientific texts, they rely on compiling references, resurfacing dormant texts, and (re)connecting texts differently. WAPF (2008, 2011) has numerous webpages dedicated to providing alternative explanations and promoting alternative practices ranging from nonindustrial models of raising cattle to analyses of milk safety. For instance, in WAPF's (2011) PowerPoint presentation it has argued—using references to scholarly articles from a variety of medical journals—that pasteurisation destroys the "bioactive components" (slide 4) in raw milk

that protect individuals from the pathogenic effects of harmful bacteria. These processes of countering state policy using existing science get used to suggest an alternative reading of what makes raw milk nutritious and safe and that pasteurisation is not necessary under all circumstances. Together, these alternative readings and individual testimonials that in the aggregate suggest some benefits accrue from drinking raw milk are not inconsequential, ideographic, or unscientific; they reveal the legitimate inconsistencies of scientific theorising that neglects what can be learned from studying and theorising individual cases (Steinmetz, 2004). The nomads foreground their experience and scientific studies they find that support their view of milk as part of their strategy to preserve the integrity of their experience of drinking raw milk safely. In contrast to royal science, the immediate, local experiences of raw milk drinkers are always happening in discursive spaces that reflect the diversity of experience, interests, negotiations, and knowledge claims.

**Discursively Configuring Raw and Pasteurised Milk as Nutritious: The Example of Enzymes**

In this section (and the next), I look at an example of how expert advice is contested by activists. Activists claim raw milk is nutritionally superior to pasteurised milk, whereas royal science argues that pasteurised and unpasteurised milk are nutritional equivalents in that pasteurised milk has the same nutritional components as unpasteurised milk and that those nutritional components are insignificantly affected by the pasteurisation process, therefore the dangers attributed to drinking unpasteurised milk are not worth the risk (Speake, 2011). However, the claims for nutritional equivalency depend entirely on how nutritional values are discursively produced.

Royal science equates the consumption of the vitamins and minerals found in milk with the promotion of health. Just before WWI, a 50-year process began of identifying vitamins and

minerals. Their identification made it possible to market foods in new ways based on the nutritional components, thus adding to the "aura of science" (Apple, 1996, p. 3), and the promise and "hope of vitamins thrilled the American public, even before scientists figured out the chemical structures and physiological actions" (Apple, 1996, p. 13). This nutritionalization still operates according to Justus von Liebig's (1803–1873) notion that foods are reducible to their chemical constituents (Porter, 1997, p. 551). Later, as those constituents were identified, only those vitamins and minerals not produced by the body were deemed as the essential nutrients needed for health, and this view continues to inform modern nutrition (Harper, 1999; Hoffmann, 2003). The discursive reduction of foods to these nutritional constituents has "proved a very useful instrument" (Kjaernes, 1995, p. 272) for planning food policy because it easily links the production of commodities with public health goals. "Got milk?" campaigns by the dairy industry exemplify how this type of discourse gets deployed to align a particular view of nutrition with the consumption of pasteurised milk and business interests. Food activists reject reductionist scientific discourses that do not also take into account the other properties of milk that activists also consider nutritionally important.

Nomads talk about nutrition through the lens of alternative and holistic medicines. Their views are informed by holistic discourses about the formation and prevention of disease. People who have access to clean and purer foods have much better opportunities for remaining healthy even when consuming potentially dangerous foods like raw milk. Through this lens, Pollan (2008) calls the royalist reduction of nutritional understanding to a few of its constitutive components *nutritionism* (p. 28). For him, nutritional completeness comes from consuming whole, organic, unadulterated, and minimally processed foods that have other nutritional components that are ignored by royal science in their descriptions about what constitutes a

healthy food. Therefore, Pollan sees the evaluation of nutritional content based on the presence of vitamins and minerals as incomplete. He sees royal science as having little insight or interest in examining how enzymes, haemoglobins, proteins, fats, minerals, and vitamins interact with bodies in complex ways and contribute to health. Bodies produce many of the enzymes needed for digestion. Therefore, the royalist view stipulates that enzymes as well as antigens, haemoglobins, and the immune support functions of whole foods have no nutritional value, thus their presence in food is unnecessary for the preservation of health (Bren, 2004). The activist, on the other hand, argues that the destruction of enzymes lessens the bioavailability of the other nutritive properties found in milk: therefore, they consider raw milk the superior choice (Douglass, 2007; McAffee, 2007; McDougall, 2003; Planck, 2006; Pottenger, 1995; Schmid, 2003; WAPF, 2011). According to this view of nutrition, milk is viewed as a complex living matrix where enzymes, haemoglobins, proteins, fats, minerals, and vitamins, all of which are destroyed, damaged, or altered during the pasteurisation process, are also viewed as essential contributors to health. Raw milk activist Mark McAffee (2007) has written about this problem, and has complained that phosphatase, lipase, immunoglobulin, lactase producing bacteria, probiotic bacteria, and delicate proteins are all destroyed by pasteurisation, while vitamins A, D, and $B_{12}$ and the minerals calcium and phosphorous are diminished. Elsewhere, he has said that enzymes strengthen the immune system and subsequently protect against the effects of pathogens and from the onset of chronic disease (Gumpert, 2009a, p. 52). These types of claims show up repeatedly in the texts of raw milk drinkers. Consuming raw milk is purported to alleviate aliments such as allergies, lactose intolerance, asthma, and hay fever (Hagan, 2006; T. Price, 2007). One peer-reviewed study suggests there may be validity to activist claims: they concluded drinking raw milk reduces the number of asthma attacks in children (Loss et al., 2011). The

royalist counter to these types of studies is that they are outcome-based and the causes associated with having better health due to consuming raw milk are not obvious and difficult to trace.

The paradigmatic differences between royal and nomadic science come into sharp focus when considering the standard used to determine whether milk has been properly pasteurised. Alkaline phosphatase (ALP) is a naturally occurring enzyme in milk, and milk that has been properly pasteurised will render this enzyme inactive: This has been the industry standard used to determine the safety of milk since it was first introduced in England in 1933 (Fasken & McClure, 1940). The status of enzymes becomes a focal point for conflict. "Got milk?" campaigns present claims about the importance of calcium in the diet, and by inference the presence of calcium in milk makes milk a healthy food. Nomads dispute the bioavailability of minerals like calcium when pasteurisation destroys the enzymes that make those nutrients digestible. Raw milk activist Douglass (2007) has written that phosphatase is essential for the absorption of calcium (p. 17). Similarly, lactase is the enzyme used to digest lactose and gets discussed in the context of lactose intolerance by Planck in her book *Real Food* (2006, p. 58). Mercola (2014) wrote on his website that raw milk has higher levels of vitamins and minerals, higher levels of conjugated linoleic acid (CLA) and all forms of omega-3 fats (linolenic acid, eicosapentaenoic acid [EPA] and docosapentaenoic acid [DHA]) are higher in raw milk. Nomadic discourses, then, reframe raw milk also as having health promoting probiotic bacteria, more than 60 enzymes, growth factors, immunoglobulins, amino acids, and proteins that all remain in a more bioavailable state when milk is consumed raw.

This is a recurring theme around enzymes. The idea that enzymes enhance immune function has shown up in WAPF's (2011) public presentations. The enzyme activity in raw milk is what makes it a "living" food essential for health and highlights in the nomad's mind the need

for royal science to study these issues in a way that determines whether the enzymes in conjunction with milk's other nutritional properties changes health outcomes when it is pasteurised and when it is raw. The nomad is demanding that discourses about raw milk as a "living" substance be taken into account and examined by royal science.

However, there is, according to raw milk chronicler Gumpert (2009a), a lack of interest by the proponents of pasteurization for funding studies that show there are substantial nutritional drawbacks to pasteurization. Activists are not only pointing to some of the limitations of scientific understanding, they also are arguing that royal science validates and invalidates the consumption of raw milk according to corporate-political interests. The example of enzymes shows how competing discourses of nutrition are contested. This view is echoed by Schmid in his book *The Untold Story of Milk* (2003). In it he wrote there is little interest by the food and pharmaceutical industries to do research on the benefits of raw milk, especially since royal science claims enzymes are destroyed in the digestive process and therefore do not have any nutritional value (pp. 84-85). Pathologist Beals (2010) disputes the royal science claim that enzymes are destroyed in the stomach and therefore their presence in foods does not matter. He wrote in *Wise Traditions* (p. 87) that the enzymes from the foods we eat are not destroyed by stomach acid, as is often claimed by propasteurisers, and provides yet another reason for demanding more studies about this circumstance.

What remains controversial and what the nomad tries to defend against is whether enzymes consumed from raw milk contribute to better health. Science journalist and regular contributor to The Bovine, Ijaz (2013), has agreed there is a need for better designed studies that could provide the definitive evidence that raw milk supporters desire. Since activists cannot do the science themselves, they make appeals to royal science hoping that royal science reconsiders their

positions on nutrition and then re-examines raw milk in that context. To demonstrate this problem, nomadic science tries to gain access to state resources by drawing from existing scientific studies related and unrelated to milk about the benefits of enzymes and then interpret and extrapolate from these studies a relationship between enzymes, milk, and health.

This search for a more comprehensive view of nutrition is rooted in activists' commitment to the works of Edward Howell (1898–1988), Francis Pottenger (1901–1967), and Weston A. Price (1870–1948). The research they did in the 1920s, 30s, and 40s is essential for understanding how activists link their reasons and experiences of drinking raw milk to science. W. Price (1939) travelled worldwide during the 1920s and 30s studying the impact of diet on dental health. He spent many years of observing the diets of isolated cultures and found that all those cultures consumed some portion of their diet raw, including the regular consumption of raw milk when and if available. Raw milk supporter and nutritional scientist Masterjohn has defended in *Wise Traditions* the scientific method used by Weston Price as rigorous nutritional and medical anthropology (Masterjohn, 2014). It is an attempt to legitimise W. Price's work to a more contemporary audience and avoid any accusations that his work no longer has scientific significance. WAPF has used his work to promote eating a traditional diet made up of whole, natural, and minimally processed foods, including naturally fermented and raw foods, grown and raised in a nonindustrial environment (Nienhiser, 2000). W. Price (1939) contrasted the modern American diet with the diets of these traditional groups as evidence that health is declining in America because of the movement toward eating more cooked and processed foods. W. Price thought this trend was the main cause of ill health in the American public and that modern science was not being used in the service of wisdom, but in the service of commercial interests. This type of thinking gets taken up by WAPF and becomes the grounds for contesting the

reductionist versions of science that are institutionalised in royal science about the nutritional value of raw milk. The organisation is not just about drinking raw milk, however. It is also about promoting raw milk produced by local farmers operating family farms in support of local communities free from corporate dominance. This type of production provides assurances in the nomad's mind about the purity of raw milk.

Within the context of returning to traditional diets and farming methods rooted in biodiversity and sustainable land use operations, the research of Howell (1940, 1985) and Pottenger (1937, 1995) was focused on the specific role of enzymes in the production of health. Their research suggested the enzymes found in raw foods and milk are essential to health because they make the nutritional components of these foods bioavailable, and therefore the presence of active enzymes are an essential contributor to health. Schmid (2003) has a whole chapter in his book *The Untold Story of Milk* about the importance of Howell and Pottenger's contribution to understanding health. Digestive enzymes act as catalysts in the digestive process, and milk is particularly rich in enzymes (Schmid, 2003, pp. 83–111). Pottenger's (1995) cat studies are often cited as evidence for eating a diet containing raw milk. During this 10-year study, cats fed a diet that included raw milk thrived, while cats fed pasteurised and evaporated milk showed signs of degeneration and intergenerational degeneration and resulted in the cats having problems reproducing themselves.

The research of Edward Howell (1898–1988) is held in similar esteem. His axiom is often cited and discussed by activists (Douglass, 2007; Fallon & Enig, 2001; Schmid, 2003; WAPF, 2000): "The length of life is inversely proportional to the rate of exhaustion of the enzyme potential on an organism. The increased use of food enzymes promotes a decreased rate of exhaustion of the enzyme potential" (Howell, 1985, p. xv). What he adds to the raw milk

activist's arsenal is the idea that human beings are born with a limited supply of enzymes, and people age and die prematurely if their enzyme supply is exhausted eating the current American diet. The idea behind consuming raw foods and their enzymes is that their presence reduces the digestive burden (Bohager, 2006, p. 15). Research done by Kouchakoff in the 1930s contributes to this view and is used most often to justify a raw food lifestyle. He found the destruction of enzymes by cooking or pasteurisation contributed to the onset of many chronic and degenerative illnesses; therefore, he concluded, some portion of the human diet should be consumed raw (Kouchakoff, 1930). His work has some contemporary support. The lack of enzymes in the food prompts the pancreas to secrete enzymes to digest the food, and overstimulation may contribute to the onset of chronic inflammation, a condition more recently tied to the onset of many medical conditions including cancer (Gonzalez & Isaacs, 1999; Mercola, 2011). The view that foods, including milk, should be consumed raw is widespread and is particularly important in the raw milk campaign because as Schmid (2003) has told his readers, raw milk has more enzymes than fruits and vegetables and the enzyme content from these foods is insufficient for the maintenance of health. Raw milk and fermented foods are therefore seen as essential if the modern person wants to get an amount of enzymes similar to what was present in traditional diets and in alignment with dietary prescriptions to avoid all denatured foods (pp. 84, 110).

Taken together, this research acts as evidence for Schmid (2003), WAPF (2014a), and supposedly other raw milk drinkers that nomads have a legitimate set of discourses through which other scientific claims may be interpreted and royal science may be challenged. This research also represents the kinds of studies activists argue are missing from contemporary research about the value of raw milk in the attainment of health. Pottenger (1937), like many in his day, was concerned that government attempts to protect infants and children from milk-borne

infections by pasteurising milk may be denying them good health by removing, damaging, or destroying the vitamins and enzymes that control mineral assimilation and promote general health and resistance to disease. The *Healthy Baby Gallery*, where parents may send in photographs of their babies fed the Weston Price way, is found in most issues of *Wise Traditions* at the end of the *Campaign for Raw Milk* section and continues to foster this view that healthy babies need raw milk and nutrient-dense foods for healthy development and proper immune function. These images reinforce the need for "caring" parents to consume milk raw.

The linking of traditional diets with the early research on the relationship between raw milk and health and the testimonials of individual consumers of raw milk is the discursive strategy employed by the nomad to make a case against royal science. Nevertheless, the nomad of the present is continually faced with the problem of legitimacy because there are few current studies looking at the specific role that milk enzymes have in health. This underscores the difficulties activists have in amassing counterfactuals. Since they do not have access to the state's research apparatuses, they rely on drawing inferences from the existing scientific literature and anecdotal testimonials that drinking raw milk improves and maintains health, all of which royal science would typically dismiss or ignore as unscientific.

**Risk as a Way of Configuring Raw and Pasteurised Milks: The CDC Versus WAPF**

If, as raw milk activists argue, there are significant nutritional and health benefits to drinking raw milk, then for the activist there is still the issue of demonstrating that raw milk is as safe as or safer than pasteurised milk. The debate between royal and nomadic science, therefore, must also be about evaluating how the risks from drinking raw milk are categorised and contested. Ontario's former premier Dalton McGuinty reiterated the government position in 2007 that raw milk is unsafe and that his "responsibility in government is to rely on the very best expert advice that we can when it comes to the safety of our foods . . . [and the] best advice

we've been getting for over 70 years now is that unpasteurized milk is unsafe—so we're not going to change our position" (Oliveira, 2007, para. 10). In the 1980s governments became more concerned about public safety after a series of outbreaks involving both pasteurised and unpasteurised dairy products received a lot of public attention. This deepened the commitment to further centralise and standardise the laws surrounding milk and its by-products (Ryser, 2007, p. 367). The result has been a further entrenchment of institutional views about the dangers of unpasteurised milk. Subsequently, institutional actors like McGuinty have made public policy, according to Turvey and Mojduszka (2005), by balancing three aspects of risk in the creation of food policy, namely, they must incorporate scientific analyses, establish administrative regulations and controls, and develop educational programs that inform the public.

The issue for nomadic and royal science is that notions of risk are not obvious nor is milk an inherently risky or hazardous food. The biggest complaint of the raw milk drinker is that royal science does not take into account that most people drinking raw milk do so safely most of the time. They see the risks as minimal, whereas royal science sees the consumption of raw milk a significant threat to public health. Attempts to make the risks and hazards experienced by the public real are ordered discursively through discourses (see Fox 1998, 1999). How ideas about risk get constructed to validate and invalidate access to raw milk is interesting. Scientific practices and the use of pasteurisation technologies are a consequence of that activity and are used to justify compulsory pasteurisation laws, which then get channelled through the supposed risky behaviours of individuals requiring social control strategies like surveillance, risk management, morality, and public safety campaigns as a way to prevent the spread of disease (Sanford & Ali, 2005). Epidemiologists contribute to an increasing need to manage populations by designing research projects that search for more risk factors for disease, the definition of

which are often arbitrary and used to justify the need for more research (Rockhill, Kawachi, & Colditz, 2000). The need to use discourses of risk became crucial as the milk supply system was increasingly organised and standardised along scientific and industrial lines. This type of organisation only became possible after the introduction of germ theory in the 19th century (Busch, 2004, pp. 170–176). One of the virtues of germ theory is that it posits germs as the singular cause of illness and allows royal science to ignore and/or under-regulate the larger environmental contexts (Barnes, 2000). Risks to the population are determined by the presence of germs in milk and used to justify social interventions even when disease is not present or is statistically insignificant. These kinds of institutionalised frameworks produce particular types of policy positions and statements.

An example of the type of scientific analyses used to frame risk and inform governments about the risks coming from raw milk can be seen in a recent CDC headline on the Internet, which read: "Majority of dairy-related disease outbreaks linked to raw milk" (CDC, 2012, para. 1), and is linked to a recent survey headed by CDC epidemiologist Adam Langer published in the CDC journal *Emerging Infectious Diseases* (Langer et al., 2012). The survey found that between 1993 and 2006, 121 outbreaks involving dairy products resulted in 4,413 people becoming ill. Forty-eight of the 121 outbreaks (40 percent) were attributed to pasteurised dairy products (including, for example, 30 caused by bacteria, 4 presumed to be caused by propasteurisation contamination, and 3 attributed to improper handling/storage by the consumer). In contrast, 73 of the outbreaks (60 percent) were caused by unpasteurised dairy products, all the result of bacterial infections. However, of the 4,413 cases, 2,842 illnesses (64 percent) were caused by pasteurised dairy products whereas 1,571 of the illnesses (36 percent) were caused by unpasteurised dairy products. Fifty-six of the 121 outbreaks involved milk, and of those 56

outbreaks related to milk, 82 percent (46 outbreaks and 1,288 cases) were attributed to consuming unpasteurised milk (Langer et al., 2012). The report found that the majority of all illnesses (64 percent) were caused by pasteurised dairy products, infecting almost twice as many people as unpasteurised dairy products (at 36 percent). Unpasteurised milk, though it caused most of the milk-related illnesses, caused less than half the number of illness caused by pasteurised dairy products. In all there were three deaths: one person died from consuming pasteurised dairy, while two people died from consuming unpasteurised dairy. The CDC's statistical analysis further added that there were more outbreaks in states where the sale of raw milk is legal, although the number of people who became ill was primarily caused by consuming pasteurised milk. Of the 73 outbreaks caused by unpasteurised milk (including, for example, campylobacter 54 percent, salmonella 13 percent, e. coli 4 percent, listeria 4 percent, and shigella 3 percent), there were also three outbreaks involving Brucella (4 percent)—also known as undulant or Malta fever.

How royal science produces its scientific analyses of risk not only informs public policy: it attempts to delegitimise challenges from raw milk activists. How those data are produced has been subjected to strong criticisms from members of WAPF. This reveals the scientific sophistication of raw milk activists as they engage in a methodological critique of the CDC study. Hartke (2012), on behalf of WAPF, responded to the CDC study and pointed to a number of methodological issues that biased the results. Not least, Hartke questioned the time period chosen by Langer et al. In 2007, the year after the study, there was a significant outbreak involving pasteurised dairy products: There were 135 cases of E. coli from eating pasteurised cheese, and more interesting, given the CDC's headline, is three people died from consuming pasteurised milk contaminated with listeria. On average, from 1993 to 2006, there were 203

cases of illness per year associated pasteurised dairy products, while there were 112 cases tied to unpasteurised dairy products. Hartke wondered why the study focused on the number of outbreaks as an indicator of risk rather than looking at the actual number of cases. She also noted that most of the cases reported by Langer et al. did not identify whether the dairy product said to cause an illness was pasteurised or unpasteurised. In comparison, there were almost 24,000 annual cases of other foodborne illness during the same time period. Other foods are not treated the same; raw milk activists often complain about the politicization of raw milk and point out that it is safer than many other foods that are not regulated to the same degree, particularly vegetables (WAPF, 2008, p. 8).

Additionally, Hartke (2012) reported that before the study, in 1985, there were more than 16,000 cases of salmonella from drinking pasteurised milk. Between 1980 and 2005, there were 19,531 cases of illness attributed to consuming pasteurised milk and other dairy products, representing 0.4 percent of all foodborne illnesses (WAPF, 2008, p. 11). Hartke also complained about what counts as a raw dairy product and the merging of different types of raw products into a single category that do not have the same incident rates; for instance, lumping together un- and under-regulated producers across different states into the same category as highly regulated producers like Organic Pastures and Claravale Farm of California. How and what data are collected play a very important role in what can be said about the risks commonly associated with raw milk consumption. WAPF (2008) has prepared its own report, “Raw Milk: What the Scientific Literature Really Says,” in an effort to dispel views that the scientific literature has a coherent univocal position on the safety of milk. The report’s authors examined dozens of peer-reviewed studies, critiqued each study individually, and argued that many have methodological flaws, misinterpret the data, and generally overestimate the statistical dangers of raw milk. It is a

strategy of critiquing the existing science to stake out a set of counter-claims that raise questions about the integrity of CDC research practices.

Activists also find support from the research of other scientists. Pickard (1997), for example, is a researcher at the Department of Animal Physiology and Nutrition at the University of Leeds and has found that the risks linked to drinking milk—tuberculosis, typhoid fever, paratyphoid fever, bacillary dysentery, scarlet fever, and staphylococcal intoxication—have all but disappeared from cowherds, brucellosis has declined, and the risks typically associated with raw milk are "now largely unfounded" (Pickard, 1997, Types of Infection Carried in Milk section, para. 1) since the end of the 1960s. The complaint activists have is that the statistical risks do not justify the government's heavy-handed oversight of raw milk producers. In the non-peer-reviewed journal *Wise Traditions*, McAffee (2004), owner of Organic Pastures farm in California, reported being monitored by the state and the FDA for pathogens in his raw milk. Specifically, these organizations monitor for salmonella, E. coli, and listeria and have yet to find any evidence of contamination (McAffee, 2004). California producers, like Alta Dena Dairy, have been producing certified raw milk since 1953 and have sold over 20,000 gallons daily without a single incident of illness (Schmid, 2003, pp. 280–281). Similarly, McAffee (2007) has produced raw milk and raw milk products for over seven years, and of the 80 million units sold and thousands of government tests, not a single pathogen has been found in any of his products. Since then, however, four cases of minor illness have been attributed to his milk (N. Johnson, 2008), but linkages were tenuous, and he was allowed to continue operations because the e. coli O157:H7 pathogen, said to be the cause of those illnesses, were not found in his cowherd (Gumpert, 2009b, p. 33). Gumpert (2009b) countered that similar tests done on commercial farms where the milk is destined for pasteurisation facilities, pathogens were detected about 30

percent of the time, suggesting to activists that animal welfare and production practices influence the levels of pathogens, making pasteurisation unnecessary under certain types of dairy production.

Neither have the dangers attributed to raw milk by government regulators convinced California lawmakers. They have sided with raw milk producers to change testing standards. In California where raw milk has never been illegal, the issue there has been about how to regulate raw milk. The most recent debate came when Senate Bill 201 (SB 201) was introduced in 2008 (Assembly Committee on Health, 2008). It was an attempt to define raw milk differently from commercial milk. The new law would have only required milk be tested for pathogenic activity rather than being tested for bacterial activity. Its passage would have changed how regulators test the safety of milk. The bill was passed unanimously in the state's assembly and 31–4 in the state senate on 30 August 2008. Despite the near unanimous support of the general assembly, Governor Arnold Schwarzenegger vetoed its passage, claiming the current legislation AB 1735 was adequate.

Activists were seeking to replace AB 1735 with SB 201 because AB1735 defines risk-free milk as milk that contains a minimum number of all forms of bacteria and did not require testing for the presence of specific pathogens. This legislation adopted a 10 coliform /mL count as the state standard for determining the safety of milk, even though coliform bacteria are mostly harmless and ubiquitous throughout the environment. They are found in soil, water, vegetation, and the intestinal tracts of animals and people. The California Department of Food and Agriculture's (CFDA) own account has confirmed the detection of coliforms only corroborates there is bacterial activity in milk and "does not necessarily mean that a disease causing, or pathogenic, form of the bacteria is present" (CFDA, 2008, para. 2). Nevertheless, the CDFA

continues to argue that since the presence of coliforms may indicate the presence of pathogens in milk, safety should be based on the number of coliforms present (Rafanan, 2008).What the coliform test provides is one standardised test for all milk, regardless of whether it is raw or pasteurised and regardless of the conditions under which the milk is produced. This legislation impacts raw milk producers: raw milk often has coliform levels that exceed this state standard because raw milk is still a bioactive substance. This type of legislation informed by science institutionalises a particular type of scientific discourse that jeopardizes raw milk production using definitional practices that link risk and illness in tenuous ways that appear to be an attempt by royal science to actively ban nomadic activity.

WAPF has continued to challenge this type of legislation. Part of that response can be seen in one of its PowerPoint presentations—Campaign for Real Milk—available on its website (WAPF, 2011). Slide 15 makes the case that coliforms and pathogens are not the same and therefore should not be regulated the same. WAPF (2011) has accused the government of operating from an "old paradigm" (slide 15), where health is preserved by eliminating encounters with germs, and have advocated a new paradigm, where health arises from a "symbiotic relationship with microorganisms" (slide 17). The presentation is fully referenced using peer-reviewed academic sources and government sources. So while the production and distribution of raw milk remains legal, the test used to determine the safety of milk makes the production and distribution of raw milk very difficult and requires raw milk producers to meet much higher standards than the producers of pasteurised commercial milk (Gumpert, 2009a). Alternatively, under SB 201, only tests that minimise dangerous pathogens rather than all coliforms would be used. Even though this simple distinction is not beyond the current ability of scientists to test,

Gumpert (2009b) has argued, these two different pieces of legislation have very different consequences for who gets to produce milk.

Another thread in this debate about safety has to do with the contamination of milk after milking. Post-pasteurisation infections are now a growing concern related to mass-produced milk (Leedom, 2006; Olsen et al., 2004). Diseases like salmonella (a typhimurium strain is now multidrug resistant; Olsen et al., 2004), e. coli, pseudomonas, yersinia, campylobacter, staph infections, and listeria monocytogenes are all food-borne diseases introduced during and after milking. These dangers cannot be separated from organising and producing milk as a commodity. The reality is that both raw and pasteurised milk are susceptible to contamination during the handling phase of production and poor storage practices by distributors and consumers. However, raw milk activists argue that because raw milk, as a bioactive substance, still has properties that have not been destroyed by pasteurisation, those bioactive substances will protect the consumer from pathogenic exposure (Douglass, 2007). McAffee (2004) sees it as ironic that in order to further control these pathogens in commercial milk, the state of California and federal regulators have approved the use of lactoferrin to reduce the number of pathogens found in that milk. The irony for McAffee (2004) is that loctoferrin is a product derived from the same enzymes found in raw milk, but which are destroyed during pasteurization.

Activists like McAffee (2004) subsequently see a future in biopreservatives. There are some scientific studies that activists have found to support their view. One study referred to by activists shows enzymes in raw milk have antimicrobial effects and act as biopreservatives but are destroyed by pasteurisation (Arqués, Rodríguez, Nuñez, & Medina, 2008). The authors of the study claimed nisin, reuterin, and lactoperoxidase, when introduced in small quantities to milk, were a “natural” method for controlling foodborne pathogens in dairy and dairy products.

Another study by Kussendrager and van Hooijdonk (2000) found that lactoperoxidase—a naturally occurring enzyme in cow's milk—acts as a biopreservative that inactivates the growth of foreign microbes in the milk. Activists like McAffee (2004) have used these types of studies to make claims about the importance of not damaging and/or destroying enzymes using pasteurisation technologies. McAffee's (2004) article went on to claim the enzymes—lactoferrin, xanthineoxidase, lactoperoxidase, lysozyme, and nisin—are all inactivate pathogens found in raw milk and make it safe to drink while preserving enzymatic activity.

**Conclusion**

Royal science enjoys enormous privilege in society, particularly with governments; not because of its capacity to observe and theorise certainty, but because it makes technological manipulation and systematic intervention in the world possible (Speake, 2011). However, this intervention using pasteurization technologies has been folded into an industrialised system of milk production and has created a profitable, corporate-dominated milk supply. This was made possible by theorising human interactions with milk through a particular theoretical lens, which in its simplicity, and when too rigidly deployed, becomes a way to rationalise particular ways of life and enact heavy-handed policies that recreate different, incompatible lifestyles as undesirable and irrational.

Raw milk activists, if nothing else, are challenging royal science's scripted responses to the dangers of drinking raw milk. In the role of nomad, activists have taken on the role of critic and contribute to that self-correcting dynamism that sustains the scientific project. Marion Nestle, a well-respected professor of nutrition, food studies, and public health at New York University, has said in an interview, "I don't see why raw milk can't be produced according to food safety standards and tested for pathogens and be safe. The whole thing seems to be blown out of proportion" (as quoted in Madden, 2008, para. 14). What I have done here is provide some

thoughts about how milk is being contested using the concepts of royal and nomadic sciences. In the nomadology, each acts as a heterogeneous domain of thought that in the context of this analysis helps sociologists to see how science operates as a discursive field that is ordered by these discursive entities and that work to privilege and subordinate competing discourses about the nutritional value and safety of raw milk.

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# CONCLUSION

## Future directions

Milk has been subject to an institutionalised metanarrative that aligns scientific understandings of nutrition, germs, pasteurisation, and illness with pasteurisation technologies and public health policy. In this dissertation I have problematized some of the contested and complex circumstances that have contributed to the formation of the metanarrative that surrounds milk in North America. What I learned as this project unfolded is that institutionalised descriptions, explanations, and practices around milk continually move toward creating static and simplified explanations that are easily administered and aligned with cultural-economic conditions. This work contributes to other critiques of science and to analyses of how medicine operates as a biopolitical and disciplinary force (Armstrong, 1995). The main overall contribution of the three papers is to show how human interactions with milk are ordered in ways that align multifarious ideas and circumstances about the role of germs in illness, nutrition, political expediency, social acceptability, and profitability. Unpacking how unpasteurised milk was made dangerous using germ theory reveals how science operated within these discursive circumstances. Subsequently, problematizing how scientists make scientific claims became central to my project, especially since scientific theorising has become the centre for authorising and legitimating knowledge claims and public policy since the 19$^{th}$ century (Bohme and Stehr, 1986). Since then, relations to pasteurised and unpasteurised milk were and are being informed by privileging of germ theory, nutrition, and the introduction of pasteurisation technologies within complex, social environments that prioritized and continue to prioritize economic and political concerns.

How milk is defined at any moment in time is a consequence of discursive activity. Since milk was and is seen as important food for the maintenance of health, it has been subject to these economic and political processes and has resulted in the enactment of compulsory pasteurisation

laws that deny people access to unpasteurised milk. The consistent thread tying all three papers together is that relations to milk are organised by discourses about germs, health, nutrition, and the safety of milk. These discourses constitute and configure milk in particular ways that form a metanarrative that appears as a coherent, rational construct that corresponds with a reality uninfluenced by economic, political and social interests. To understand milk, I problematize the metanarrative by examining some of the conditions that resulted in the acceptance of scientific claims and the enactment of compulsory pasteurisation laws.

Central to my analysis is the Foucauldian view that discourses are already relations of power that provide the possible conditions for action while also acting as strategies in the production of scientific claims (Bălan, 2010). Discursive activity is a productive force. Therefore, science is already political. It is not just about the politicisation of the scientific claims by those laypersons outside of science; rather I reveal that milk is the product of discursive activity.

To analyse the extent to which interests are instantiated within scientific claims I use the genealogical method for revisiting and unpacking the metanarrative. This method is useful because it points to and problematizes some of the ideas and practices past actors had in their efforts to understand their relationships to milk, which have since had an impact on our beliefs about milk in the present. To understand North American's contemporary relations to milk meant destabilising the claims of the metanarrative and examining how science as a disciplinary technology is used to discipline the individual. I do not offer solutions or offer an alternative view about how the debates about the nutritional value or safety of pasteurised or unpasteurised milk should be resolved. Rather, I use the genealogical method described by Koopman (2013) and Mills (2003) as a form of critique to problematize the metanarrative. The genealogical

practice of looking for alternative, contradictory circumstances allowed me to revisit some of those 'moments of contestation' that established a particular agenda for thinking about milk that has since had a direct or indirect impact on how we relate to milk in the present.

My analysis of milk shows that government administrators, scientific researchers, and medical practitioners worked to conceptualise milk and create policy by developing metrics, systems of classification, and categories of illness. The creation of these had the appearance of separating science from social influence and capable of making appeals to a concept-independent reality. In papers one and two, I sought to examine those existing patterns of thought—those beliefs, philosophies, theories, etcetera—that enable and constrain an actor's ability to think about a thing or a set of events and act on them. I used the work of Latour and others in the field of STS as a critical starting place for examining the metanarrative because they reflect a body of research that has already demonstrated the inability of scientists to produce certainty precisely because they cannot access a concept-independent reality. Rather, Latour, in his book *On the Modern Cult of the Factish Gods* (2010), examines how knowledge is produced by social actors discursively from within particular historical contexts that interpret the observation of regularities of the world. In that context, there are no transhistorical concepts or objects, only changing accounts that produce changing bodies of knowledge. Scientists, therefore, cannot make appeals to a reality outside of discourse in order to justify their claims. "Reality," as Latour and Woolgar (1986) have long argued, "cannot be used to explain why a statement becomes a fact, since it is only after it has become a fact that the effect of reality is obtained" (p. 180). This line of argument is consistent with a Foucauldian view that discourses order the world through discursive activity. That is, there is no logical way to justify an appeal to reality outside of discourse. Therefore, in the tradition of Latour, I saw my analytical role not as one of articulating

yet another set of epistemological and ontological insights claiming to represent reality, but, as Latour puts it, one of preserving "the diversity of ontological status against the threat of its transformation into facts and fetishes, beliefs and things" (Latour, 1999, p. 291). Meaning, it is a pointless pursuit to "discover" a reality beyond perception—or beyond discourses.

On this point I see similarities between Foucault and Latour. They both see science as a social practice that orders the world as a means to bring thought, observation, and experience together to create socially coherent explanations and practices. Foucault's regimes of truth are the ordering of discourses to serve social purposes. Consequently, I have not attempted to contribute to Latour's ongoing concerns about how science produces more stable accounts of reality. Rather, his insights reveal the difficulties scientists have in using scientific method to describe and explain the world and results in uncertainty—a discursive space—that I have exploited as a philosophical and evidential basis for my examination of how Foucault's power-knowledge nexus operates as a strategy for configuring discourses (Bãlan, 2010). Using Latour as a critical starting place for my analysis is important for two reasons. First, I did not have demonstrate that scientific knowledge is a product of social activity. Second, it allowed me to pursue a strong constructivist perspective (see Fox 1998; Lupton, 2013b) that views hazards as well as risks as the product of discursive activity because, as Latour suggests, there logical way to distinguish beliefs from facts. This makes it impossible for scientists to say definitively what counts as legitimate evidence and what does not. This inability to be definitive, raises questions regarding the appropriate methods for examining milk and what constitutes a legitimate explanation about pasteurised milk's nutritional value and whether unpasteurised milk is an inherently dangerous food.

Within the broader context of food scares and safety, this discursive activity means that the hazards as well as the risks attributed to drinking milk are both socially constructed (see Fox 1998, 1999). Therefore, I made no attempt to treat the hazards attributed to milk as representing insights into a context-independent reality and then discuss risks as a response to those hazards, which is the practice of weak constructivists and naïve realists (Lupton, 2013b, pp. 49-50). For them, risks are projected onto hazards because it is assumed that science has some epistemological and/or ontological access to nature. In my view, hazards and risks are both discursively constituted and produce discourses that cannot make appeals to a reality outside that discursive activity (Kendall and Wickham, 1999). Moreover, the claims scientists make about milk arise discursively through discourses that are already instantiated as relations of power. My so-called strong constructivist view of how knowledge is produced is simply an acknowledgement and critique of how scientific representations of reality are achieved discursively.

Foucault's genealogical method allowed me to point to some of those problems. For Foucault, these perceptions are transformed into scientific claims from within systems of power. These systems produce discourses that circulate as the accepted and acceptable fields that organise how and what can be thought and establish the conditions for action. These discourses are not only a product of existing relations of power; it is from within the relations of power that discourses are constituted. Milk is defined as an object of concern through scientific discourses that not only circulate within scientific communities but are also reflection of the non-scientific discourses that circulate in the broader social context about milk as a commodity and socially valued food. Pasteurisation technologies acted and continue to act as a productive force that make unpasteurised milk dangerous and pasteurised milk nutritious. In that sense, there is little

value in trying to separate risks from hazards or positing nature as an accessible reality outside of discourse. The claims scientists make about milk cannot be found outside discursivity. The importance of a genealogical approach is that histories are sites for problematizing how we come to "know" the world so that transformation in the present remains a possibility. The metanarrative actively marginalises and suppresses those possibilities by imposing static interpretations onto milk.

The first two papers are genealogical explorations of some of the conditions that make our current interactions with milk comprehensible. That is, they are attempts to understand how the epistemological fields that produced the metanarrative were constituted within a specific cultural-historical context committed to maintaining the availability of milk as an affordable, nutritious, and safe food. This effort culminates in a discourse analysis deployed in the third paper. In it, I analyse how different state actors and raw milk activists use different strategies for employing and deploying scientific findings in order to defend their views of how to interact with milk.

The first paper is a conceptual piece divided into three excavations that examine how our interactions with milk are not governed by epistemological and ontological insights into reality, but rather by perceptions and preconceptions that circulate as regimes of truth that have contributed to and continue to reproduce milk as simultaneously dangerous and nutritious. The first excavation examines how germs became the "cause" of disease. Germ theory makes milk dangerous in a scientific way that is now the primary theory coordinating the metanarrative. Historian David Wootton (2006) argues that theorising germs as the cause of disease is what finally gave medicine legitimacy during the last decades of the 19th century. Nevertheless, the acceptance of germ theory was not a simple process of discovering bacteria and observing their

role in bodies. Their relationship to diseases in humans had been conceptualised; extracted from complex philosophical and social circumstances in a physical environment where medical practitioners had limited ability to observe the internal workings of healthy and sick bodies and could not observe germs changing bodies from healthy to ill states.

The second excavation examines how the problems of asserting cause limited medical diagnoses to categorising and classifying social spaces instead of bodies and medical interventions to eliminating and/or managing pathogenic exposure. The idea that germs attack bodies is a metaphor that orders our understanding of illness in particular ways and allows for certain kinds of biopolitical interventions that organise the production and distribution of milk while delegitimising others.

The third excavation is an attempt to show that scholarly efforts to read back on to history a narrative of progress is very problematic. I use a number of scholarly works to show how the safety of milk is contested using historical analyses. The goal is not to use any of the texts as authoritative but to show the contrasts and contested nature of scholarly claims. I do this because the metanarrative is in many ways an historical claim. It claims that germ theory and pasteurisation technologies made milk safe and subsequently prevented people from becoming ill. This situation raises questions about how we should relate to milk in the present.

The intended contribution of the first paper is to show that appeals to history and past science are problematic. Scientific representations about the role of germs were organised around ideas that were said not to be empirically observable and/or demonstrable (Mettler, 1947; Koch, 1901). The issue of cause remained contested. Scholarly readings of history are equally problematic. Scholars have not definitively established the relationship between disease and milk (Atkins, 1992; Bibby, 1944; Cutler & Miller, 2005; Leavitt & Numbers, 1985; McKeown, 1979;

McKinlay & McKinlay, 1977), nor has the effectiveness of pasteurisation technologies in lowering the incident rates of disease been settled (Atkins, 2000; Jenkins, 1926). Problematizing milk in this way reveals the uncertainty that informs preventative health models and shows how state power is deployed to discipline the public by changing its attitudes and beliefs about milk.

My second paper is published in *Studies in History and Philosophy of Biological and Biomedical Sciences* Studies. In it, I argue the theorising around germs in relationship to humans had to have within it an acceptable and practical response to illness, namely the elimination of germs using technologies and regulation, which were consistent with the dominant allopathic belief that the specific aetiologies and the pathogenesis of disease are determinable. This orientation to theorising contagious disease, however, has limited capacity to explain the virulence of germs, the randomness of infections, and the interactivity between germs and between germs and bodies (Speake, 2011). These theoretical limitations reoriented the focus of medical activity onto managing the safety of milk. Under those circumstances milk becomes dangerous and in need of cleansing.

The metanarrative surrounding milk arises because germ theory, pasteurisation technologies, nutritional categories, political regulatory systems, and economic interests intersected in ways that made the distribution and production of safe milk possible. Under those conditions milk retained its cultural-scientific-political importance as an essential food item. Pasteurisation technologies align well with germ theory. It allows the scientist-technician to manage the levels of exposure to pathogens through technological intervention. These technologies were also amenable with existing political and economic frameworks that made their implementation possible. In the first and second papers I point to some of the problems that were raised about the efficaciousness of pasteurisation technologies during that time of "crisis".

Its value was contested then, and its effectiveness continues to be disputed in hindsight by academics and raw milk activists. Emerging discourses in the field of nutrition allowed nutritionists to create nutritional equivalencies between pasteurised and unpasteurised milks. The misgivings people had about the effects of pasteurisation could be assuaged by appealing to nutritional experts that employed a reductionist paradigm that linked health to the specific nutritive components found in milk.

These past debates are contributing to the uncertainty and distrust raw milk activists have about scientific claims in the present that is asserted in their books and online publications. Medical Doctor and raw milk activist William Douglass (2007) uses these types of inconclusive findings to argue that milk is being unfairly targeted by governments today (pp. 7-31). Raw milk activist Ron Schmid (2003) similarly critiques claims about the dangers of consuming unpasteurised milk in the past. This contributes to analyses about the growing distrust some milk activists have for science and government (Enticot, 2003; Gliessman 2012, Gumpert, 2009; Murdoch & Miele, 1999; West 2008). My study of milk shows that once science accepted germs as a causal explanation for contagious disease, it uses that theoretical lens exclusively to organise milk drinking in ways that ignore the past and present experiences of safely drinking unpasteurised milk. I claim science does this through the mechanisms of an ideational regime, first postulated by Somers and Block (2005), as a way to link theory with usable technologies. It allows germ theory and pasteurisation technologies to validate one another. This type of alignment between theory and practice can be found in the work of Mol and Berg (1994). Their investigation found that medical practitioners comprehend and diagnose health and illness through a strict adherence to the dominant theoretical perspective that subsequently determines what is considered legitimate evidence and practice while ignoring other evidence that does not

fit the authorised theoretical model. Ultimately, the use of pasteurisation technologies to manage the theoretical linkage between germs and milk extracorporeally led to a biopolitical strategy of moving milk into the category of permanently dangerous.

The third paper employs a type of discourse analysis described by Luke (2002) to show how state actors, raw milk activists, respond differently to discourses about nutrition and risk. Each group has its own set of interests and ways of interpreting milk. Other discourses about corporate manipulation, corporate power, state collusion, choice, democracy, freedom, purity, rights, health, and autonomy and control over their bodies and life circumstances are also effecting the activist's pursuit of raw milk (Salatin, 2009, p. ix). Among raw milk activists, there is definitely a desire to return to more wholesome, minimally-processed, and locally produced foods. This is consistent with Murdoch, Marsden, and Banks's (2000) view that people seeking natural and organic foods are engaged in the "quality turn".

It is not, however, an uncritical turn as they assert is happening with many natural and organic shoppers. Activists recognize the privileged position of institutionalised science, therefore they focus their challenges on the state metanarrative by using existing science (West, 2008). The state uses food scares involving raw milk as a tactic for creating fear and as a disciplinary technique to dismiss the goals of raw activists (Langer et al, 2012). Therefore, food safety issues are almost exclusively talked about in terms of managing pathogens that contaminate milk in the post-milking phase and managing farm hygiene (Gumpert, 2009b, pp. 118-129; Weston A. Price Foundation, 2008, 2011). Activists are not only challenging notions of risk, they are also challenging claims about what and where in the environment hazards are being produced. Activist William Douglass MD (2007) challenges the history of the food scares attributed to milk, the effects of homogenization and pasteurisation, and how bacteria are

regulated and effect health (Douglass, 2007, pp. 9-65). Vonderplantiz and Douglass have made the following statement in a report given to the members of the Los Angeles County board of Supervisor:

> The pasteurization of milk had no effect on the incidence of tuberculosis caused by milk. Humans can drink milk from a tubercular cow with impunity. In cows, the blood-membrane barrier prevents the tubercule bacteria from passing into the milk. Intestinal TB was previously believed to be caused by tubercular milk from a tubercular milker hacking into the milk pail. All of that was merely speculation. Regardless, all of this has been eliminated by closed-system automatic milking machines. Presently it is rare to find a cow with active tuberculosis.
>
> Similarly, the incidence of brucellosis, or undulant fever, contrary to popular opinion, was really not affected by pasteurization or milk. Brucellosis is not contracted through milk. It seems to be due to direct contact with animals, especially in slaughter houses where humidity suspends animal cells released into the air from butchering. Farm-children who drank so much milk, seldom got the disease. It cannot be scientifically attributed to milk (Vonderplanitz and Douglass, 2001, pp. 34-35).

The veracity of these types of statements was not my concern. They reflect the discursive activity that is trying to constitute milk in different ways. The intended contribution of this article is to show how milk is being contested and how it is situated within the broader context of food security and food scares involving other foods the government regulates for safety. WAPF sees these government regulations as unjustifiably biased against raw milk (Weston A. Price Foundation, 2007, March 12). State actors and activists are able generate different narratives about milk intended to affect political outcomes because science represents milk in particular

ways that can be challenged. Activists use the existing scientific literature to frame different nutritional paradigms and notions of risk to argue their cases. These disputes build on and continue to show that the paradigmatic lens through which milk is viewed changes what makes milk dangerous and nutritious.

Together, the three papers show how these attitudes, beliefs, scientific explanations, and practices past and present about milk are coordinated through a metanarrative that claims pasteurised milk is nutritionally equivalent to raw milk and that pasteurised milk is safer. Therefore, the discourses of nutrition and safety are central to the propasteuriser's and raw milk activist's claims about whether the state should allow the public to consume raw milk. Secondarily, these two discourses are also central in organising other approaches to milk. That is, other discourses about the importance and viability of the family farm, local production as way to reinvigorate local economies, resisting corporate dominance, etc., all depend on how these two primary discourses are resolved. If pasteurised and raw milk really are nutritional equivalents, then the effects of drinking pasteurised and raw milk on health are insignificant, and therefore undermine the claims of raw milk activists about the need to drink raw milk. However, if there are significant improvements in health outcomes from drinking raw milk, then the issue about drinking raw milk safely becomes the central issue. If raw milk cannot be drunk safely then the health benefits derived from drinking raw milk may not be worth the risk. However, if raw milk activists can show that drinking raw milk is safe, then there is no reason for the state to prevent the distribution of raw milk to the public. The centrality of these two discourses and the need to reach some resolution are unavoidable. Therefore, in my view, it is not an accident that these two issues were and are contested so strongly and our understanding of milk depends so heavily on how these discourses are contested and subsequently used to create public policy, particularly the

enactment of compulsory pasteurisation laws. My examination of these discourses in different historical contexts shows that in each historical moment those assertions about milk rest on scientific claims that are uncertain and worth contesting.

**Analytical Constraints**

This project is a modest attempt to think about the problems past and present actors had and have in effectuating and coordinating the relationships between beliefs and facts with respect to milk. There are, according to Latour and Woolgar (1986), no inferior or superior ways for understanding reality—there are only different ways of creating order out of disorder (p. 27). There are only different accounts, each with their own sets of problems, and there is, they conclude, much more research needed to determine how the validity of different accounts is determined scientifically (p. 258). Within that context, I see milk being constituted in ways that matter to propasteurisers and raw milk activists as each attempts to constitute milk in "scientific" ways that protect milk as a culturally desirable commodity. My analysis of milk reveals how royal science generates and responds to discourses in their effort to sustain this cultural desire. They do this by aligning scientific notions of maintaining health and avoiding illness with that desire.

Simpson (2006) is similarly engaged in other aspects of this type of analysis that shows how science works to align its activity with existing social forms. She examines how the miasmic theory of disease was in part displaced by germ theory in the late 19th century because germ theory was more compatible with the processes of industrialisation. Views about social connections and responsibility were shifting and illness was no longer seen as a collective problem. Rather, the responsibility for becoming and overcoming illness became an individual responsibility amendable with new emerging patterns of culture and work. Now medicine may be entering a post-germ theory era. Todd (1990) suggests medicine may be in transition to a new

era as germ theory continues to fail to explain why some people do not become ill. He argues that there is pressure on medical theorists to give a more accurate account of how bodies become ill. My goal is to contribute to this pressure by destabilising the reified points of view that reinforce the metanarrative.

Methodologically, genealogies are useful because they problematize different moments of contestation. This approach is useful for revitalising trivialised moments or recalling those alternative narratives and/or moments that no longer fit the existing narrative as a way to consider whether contemporary ways of thinking about milk are still relevant. This is the strength of a genealogical approach. It challenges existing metanarratives. Germ theory and nutritional sciences have conceptual weaknesses worth remembering when you consider the "gap" I have described between scientific representations and the claims raw milk activists have about the nutrition and safety of milk. In the first and second papers, I employ a genealogical method to remind a reader that the metanarrative surrounding milk is problematic. Genealogies are a tactic for revitalising trivialised moments and/or recalling those alternative narratives that no longer fit the existing metanarrative. This is their strength. At their best, genealogies recall problems as sites for possible reengagement. They do not attempt to solve the problems they expose. Likewise, my analysis does not attempt to offer an alternative way to relate to milk. It ends, I hope, by raising more questions than it answers.

However, this tactic may also be seen as its limit. Genealogical analyses are a particular type of analysis that by itself have little value. They are suggestive rather than prescriptive, and therefore have a specific analytical role within a much broader discursive arena. It is part of a process of critique that may have little direct practical impact. Therefore, genealogies only have value as a form of analysis, if it can convince others of the need to reengage or continue to

engage with some aspect of the problems it raises. If it encourages others to reengage with the problematic beliefs, theories and evidence surrounding milk, then it has been successful, and in that sense, genealogies contribute to the processes of critique that challenge the status quo and encourage the need for further research. Through this process, I have attempted to revisit some instances that show how germ theory became accepted even though an understanding of how germs interacted with bodies remained unknown. Because of this uncertainty, milk became a biopolitical object and a site for intervention. What is interesting about the forces that reconfigured milk as dangerous but nutritious is the interplay between theorising and evidence—the way evidence is filtered through research designs, the way data is subject to shifting and unclear categories, and the way choices around data collection are made impact and are impacted by philosophical beliefs about the validity of a theory and the evidence that should be sought. This remains problematic because medicine continues to read milk through a metanarrative that cannot explain why some people become ill while others do not when drinking unpasteurised milk.

All these issues remain salient today. That was the point of my analysis in the third paper. In it, I unpacked one instance of how a scientific survey continued to be read and counter-read to show how data and theory converge in ways that are peculiarly unscientific. The decisions about how to define categories, time spans, etcetera is often done to "fit" the existing belief about in a theory. This is done by both sides, and demonstrates that there is an interpretative element to science that changes perceptions about the pathogenesis of illness and its specific causes, further demonstrating that scientific method itself operates within an existing cultural context without access to a concept-independent reality. A sociological analysis of these processes also suggests that the production of health, nutrition, and safety are unstable and transitive accounts. More

work on understanding the relationship between health and nutrition is essential. It seems unlikely that health can be reduced to the consumption of certain nutritional components. This creates a space for raw milk activists to introduce their more holistic point of view about nutrition. These debates around milk may push "royal" science to study more comprehensively the long-term effects of eating a diet low in enzymes, antibodies, and etcetera. Depending on what these studies find, it is possible that current beliefs and attitudes about the value of pasteurisation could change and become a new normal.

**Directions for future analyses**

Metanarratives play an essential role in creating stable, totalising descriptions about the legitimate ways we should think and act (Lyotard, 1979, p. xxiv). They create and sustain the conditions for some form of authorised and necessary types of action. However, in whatever form they take, they require continual unpacking to expose the relations of power, the reasons for claims, and the disciplinary techniques used to enforce their acceptance. In these attempts a constructivist approach to knowledge, a genealogical approach to understanding how the present is constituted, and discourse analysis reveal how power, dominance, and inequality are made manifest in society

These remain useful conceptual tools for researching and analysing other topics of interest. They will be particularly useful for problematizing issues around health and continuing to investigate how scientific activity contributes to a societal understanding of health and illness. Genealogical analyses and DA can be used to examine the histories and complexities that prefigure current medical claims and configurations that then get used to justify particular forms of biopolitical interventions. Foucault has been critical of these types of intervention because they are overly deterministic by subjugating subjects to the narrow formulations of medical expertise (Foucault, 2003b). This type of critique includes examinations of how people align

with or resist medical prescriptions. As with my examination of milk, a useful methodological technique for entering those types of analyses is through those actors being subjected to the imperatives of the metanarrative or through those actors already actively resisting those imperatives.

In particular, genealogy and DA can be used to examine how dietary prescriptions and nutritional accounts are being constituted through corporate-economic-scientific interests and then used to challenge cultural foodways and to discipline people deemed unhealthy. These types of research strategies can be used for studying the so-called "obesity crisis," which presents fatness as a risk factor in the onset of many different types of conditions and diseases. The *Handbook of Obesity Treatment* (Field, Barnoya, & Colditz, 2002) claims that being overweight or obese exacerbates chronic diseases, contributes to cardiovascular disease, certain cancers, diabetes, hypertension, osteoarthritis, gallstones, musculoskeletal problems, emotional and psychological problems as well as early death (pp. 3-4). In reviewing the scientific literature, Oliver (2006) alternatively finds there is little evidence supporting the view that being overweight or obese causes disease or that being slim is healthier. There is no weight at which the onset of disease becomes evident (p. 26). Flegal (2005) has found mortality rates for the overweight and obese in relation to normalised weight categories have been declining in recent years. Aphramor (2005) even questions the ethics of medical professionals prescribing dietary advice to overweight or obese patients as a way to lose weight and improve health since ninety-five percent of patients treated using existing food guidelines fail to lose significant amounts of weight or keep it off permanently. In treating size as a behavioural issue—that is, as one of nutritional incompetence and lack of discipline—clinicians ignore biology whereas other research shows that people come in a variety of sizes and shapes and that it is "almost impossible

to maintain" a weight outside an individual's biologically predetermined range (Kolata, 2007, p. 221). Lupton (2013a) also examines the discourses around fatness and sees the relationship between fatness and illness as a socially constructed interpretation (pp. 7-8). The medical categories of overweight and obese are arbitrary and rooted in cultural and historical circumstance (p. 34). Yet, defining people as overweight moves them into permanent categories of medical risk where they are in need of medical supervision and intervention.

In the future, I intend to continue using discourse analysis (DA) to unpack these types of claims and practices. As a well-established research method, it can be used to deconstruct social phenomena in an effort to recontextualise these issues. Therefore, DA is useful for examining relations of power and reintroducing complexity to the metanarratives that circulate in society (Wodak and Meyer, 2009, p. 2). It is a diverse "mode" of analysis that can be used to analyse how relations of power manifest through the manufacture of theories, descriptions, and explanations that are socio-politically situated within specific historical contexts (Van Dijk, 2001, pp. 352-353). DA is well-suited for examining the arguments and counterarguments used to reproduce and transform existing metanarratives, which in the case of overweight and obese bodies prescribe what to eat, link fat bodies with illness, and individualise the responsibility for being overweight and obese while minimising corporate-societal responsibility. Discourse analyses would allow me to identify the mechanisms of power that contribute to the formation of any metanarrative used to marginalise and manage fat bodies.

Clearly, genealogy continues to be useful for understanding how fatness is constituted as problematic. As a method for deconstructing accepted truths, it can be used for problematizing what constitutes a healthy diet, a healthy person, and etcetera. It is a way of showing that ideas about diet and well-being are not grounded solely in scientific rationalities (Turner, 1982), but

harmonized with other interests such culture, economics, and politics. The beliefs and facts about fatness, like milk, are coordinated in precise ways through metanarratives that now specify scientifically approved diets, eating habits, and forms of exercise that contribute to the normalisation of particular types of bodies.

**Conclusion**

This dissertation has demonstrated that it is unreasonable to continue framing unpasteurised milk through a simple binary of dangerous versus safe or to continue valuing milk in terms of a reductionist nutritional paradigm. It is by no means an exhaustive exploration, nor was it meant to be. There are limits to archival engagement. Scholarly articles are, by design, abbreviated attempts to introduce an idea or set of ideas that offer a perspective that contributes to the understanding of some aspect of a particular topic that may influence other similar investigations. Such is the case here.

The metanarrative operating in Canada and the United States has become an arcane static narrative that mostly serves corporate distributors of pasteurised milk and protects it as a particular kind of commodity that has a longer shelf life and can be traded over long distances. However, different practices in Europe show that it is now possible to administer and regulate milk safety differently than has been prescribed in the pasteurisation model. Countries like Austria, Britain, Croatia, France, Italy, Slovenia, Spain, Switzerland, and the Netherlands, in response to activist and public pressures, are now even introducing raw milk vending machines to distribute raw milk to the public (Brasch, 2014, para. 1; Deike, 2014, para. 1). The view emerging in many European nations is that raw milk is nutritionally superior and "offers a wealth of nutrition—all without the drawbacks of oxidized fats, denatured proteins, antibiotics or growth hormones typically found in pasteurized and processed milk products" (Deike, 2014, para. 2). Clearly, ways to distribute raw milk safely are being developed thus allowing for

changes in public and scientific ideas about the "inherent" dangers that the metanarrative inscribes on raw milk.

In my analysis, I use genealogy as a method for problematizing claims (Koopman, 2013) and discourse analysis (Foucault, 1989; Luke, 2002) to further unpack the processes that contribute to the formation of the metanarrative. Metanarratives are always problematic constructs. They are, on the one hand, essential for political-social action in that they provide a framework for intervening into life. On the other, they organise around fragile sets of assertions and evidence that are contestable on multiple fronts. My intention was not to side with science or present science in more credible ways that produce convincing explanations and policies the public should trust. Nor has my analysis been about bringing science and the public together in meaningful ways. Rather, this dissertation has argued throughout that scientific practices, through its systems of classification and the development of metrics, generate institutional narratives that contribute to the distrust raw milk activists have about the nutritional value and safety of raw milk compared with pasteurised milk. This distrust is rooted in how scientists legitimize knowledge claims precisely because of the activist's experience of drinking raw milk safely and the knowledge they have that other jurisdictions allow for the sale and distribution of raw milk. These two things do not align with the existing metanarrative circulating in Canada or in the United States. Therefore, this dissertation has examined the conditions that produce milk as simultaneously dangerous, yet still recommended for its nutritional contributions to the maintenance of health. Once milk became an object of scientific study, interactions with milk were reconfigured in accordance with scientific theorising about germs as well as the benefits and efficaciousness of pasteurisation technologies. The experience of drinking unpasteurised

milk safely falls outside this scientific view of milk and it is in that discursive space that the limitations of science were revealed and the various claims about milk were made contestable.

The papers in this dissertation matter because they show how science has and continues to contribute to the formation of the metanarrative that surrounds milk. By destabilizing and deconstructing that metanarrative using genealogy and discourse analysis, I have provided insights into how scientific knowledge claims are produced as relations of power (Foucault, 1980). This matters because scientists' attempts to develop variables, categories, systems of classification, and metrics, which they used and continue to use to configure milk as nutritious and safe, reveal the limitations of science, namely, that its claims must be authorised and legitimated through processes external to its methods. Therefore, scientific projects and research must always intersect with other interests, such as the food and health industries' interests, to produce acceptable and profitable food. In other words, the claims of agriscience, agribusiness, and science more generally are already discursive spaces where other scientists, food and health activists, and social movement actors may enter into critique by problematizing scientific claims, practices, and ultimately government policy. My research shows how inconsistent findings, questionable methods and practices, contradictory conclusions, and overly restrictive policies all contribute to resistance.

Subsequently, my research, while focused on the case of milk, can be used to critique science and its contributions to the formation of metanarratives in other cases where scientific knowledge is used to produce claims about health, nutrition, and/or food safety. Activists and social movements such as the organic and the slow food movement have emerged to challenge the food industry and the science that supports industrial agricultural practices. My analysis in the third paper provides some insight into how the public uses existing science coupled with

personal experience to resist state-corporate impositions on culture and lifestyles. How activists contest industry and the state can be examined by looking at the different ways in which discourses are 'taken up' by different actors to support or contest institutionalised metanarratives. My use of genealogy and discourse course analysis as methods for problematizing metanarratives shows others the possible entry points for resisting disciplinary attempts by governments through health and safety policies that marginalise portions of a population.

There needs to be a reimagining of the relationship between science and the public. There has been a tendency, in managing the relationship between science and the public, to treat science as unproblematic and to characterise the debate as one where the public is at fault because of its lack of comprehension (Irwin & Wynne, 2003, p. 4). However, Irwin and Wynne (2003) point out that science is social in the sense that scientific practices embody "assumptions about the social world" (p. 4). Furthermore, they add that the relationship between science and the public needs to include an analysis about how scientists produce knowledge within broader social contexts (pp. 8-9). In practical terms, Jamison (2006) suggests the public should be able to contribute to the production of scientific explanations and policy through participation in the institutions that produce these claims and policies. While metanarratives are necessary, change comes through a willingness to continually engage and challenge scientific and political narratives (Deleuze and Guatarri, 1987, pp. 1-25). My research opens up a way in which this may be accomplished. In the future, I will continue to use this strategy of critiquing scientific-political metanarratives because it opens up a discursive space that leads to other discussions about the relationship between science and the public interest, about the enactment of public policy, and about the limitations of science.

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