

FROM THE EDITORS OF
THE NATIONAL BESTSELLER *FUELING THE FUTURE*

FEEDING THE FUTURE

FROM FAT TO FAMINE

HOW TO SOLVE THE WORLD'S **FOOD** CRISES

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AND EVAN SOLOMON

INGREDIENTS: WATER, DEXTROSE, WTO, WHOLE WHEAT, POLYSORBATE 60, WILLIAM ATKINSON, SORBITAN MONOSTEARATE, XANTHAN GUM, AQUACULTURE, ARTIFICIAL AND NATURAL FLAVOUR, KELLY BROWNELL, TOMATO POWDER, SEED SHARING, SEASONING, CARRIE BROWNSTEIN, BSE, WHEY, MONOSODIUM GLUTAMATE, SODIUM CITRATE, NEURACEUTICALS, SODIUM STEAROYL-2-LACTYLATE, MONOGLYCERIDES, MARK JUHASZ, GLUCOSE-FRUCTOSE, YEAST, OBESITY, OAT HULL FIBRE, VEGETABLE OIL (SOYBEAN AND/OR CANOLA), STUART LAIDLAW, SORBIC ACID, GMOS, CALCIUM CARBONATE, WHEAT GLUTEN, ANNA LAPPÉ, SODIUM CASEINATE, INDUSTRIAL AGRICULTURE, MODIFIED CORN STARCH, CERTIFIED ORGANIC, GUAR GUM, COLOUR, FRANCES LAPPÉ, CALCIUM HYDROXIDE, DIACETYL TARTARIC ACID, IAN MacLACHLAN, HYDROGENATED VEGETABLE OIL, *E. COLI* O157:H7, SALT, SYLVIA OSTRY, PARTIALLY HYDROGENATED AND MODIFIED COCONUT AND PALM KERNEL OILS, CARL SAFINA, CALCIUM PROPIONATE, DISODIUM INOSINATE, DISODIUM GUANYLATE, JANE THOMSON, MALIC ACID, SODIUM POLYPHOSPHATES, DAVID WHEELER, CORN SYRUP (MAY CONTAIN PALM OIL OR MONOGLYCERIDE CITRATE), ERIC SCHLOSSER, SKIM MILK, SODIUM ACETATE, FLORENCE WAMBUGU, SULPHITES, SOY PRODUCTS, DIGLYCERIDES, SPICE, KEVIN SIU, TRANS FATS, MAY CONTAIN PEANUTS.

02.

**BETTING THE
FARM: FOOD
SAFETY AND
THE BEEF
COMMODITY
CHAIN**

IAN MacLACHLAN

ON MAY 20, 2003, the discovery of a single cow infected with bovine spongiform encephalopathy (BSE) — mad cow disease — from Marwyn Peaster's farm in Peace River, Alberta, heralded an economic catastrophe for Canadian cattle producers. Over thirty-three countries closed their borders to Canadian beef exports. The potential negative impact of a \$2.5-billion loss in cattle exports will translate into a \$2-billion loss in GDP, a \$5.7-billion decline in total output and 75,000 jobs lost.¹ BSE made the front page not because efforts to prevent the entry and transmission of BSE had been too little, too late, and not because of the potential human health risks — but largely because of the enormous disruption caused to Canada's cattle markets and regional economies. In fact, BSE was not diagnosed until over three months after the cow had been condemned as unfit for human consumption and slaughtered. Meanwhile, the carcass had already been rendered into livestock feed.

Consumers have been questioning food safety for over a century. From Upton Sinclair's *The Jungle* in 1906 — an exposé of unsanitary food handling in Chicago's meat packing plants — to Eric Schlosser's *Fast Food Nation* in 2001, the livestock and meat-packing industries have lent themselves to alarming accounts. A century ago, the prevalence of bovine tuberculosis spurred the establishment of government-sanctioned meat

inspection, while today meat is associated with a new set of diseases. The fact is, after all the science, all the guidelines and all the exposés, we still do not understand all of the risk factors or how to respond to them. As we'll see later, the risks posed by BSE were mismanaged in the U.K. and Canada's own BSE policies are questionable.

Which explains why, despite all the headlines about BSE or *E. coli* O157:H7, the greatest contemporary challenge faced by the cattle and beef industry, its regulators and public policy makers, is risk management. Consumers rely on their government to oversee farm-to-fork quality assurance programs. These programs span a long commodity chain that is often hidden behind closed doors and divided between federal and provincial jurisdictions. If we as consumers are to understand the risks to beef safety, and, most importantly, understand what ingenuity can be brought to the process to manage these risks, we need to understand the industry itself.

THE CATTLE-BEEF COMMODITY CHAIN

As with all other food, the production of beef is vertically organized into a sequence of activities — the commodity chain — which adds value to basic organic ingredients: grass and cows. The first link in the chain, calf production, is found on specialist farms known as cow-calf operations, and also takes place among other activities on mixed farms. As the gestational foundation of the commodity chain, beef cows are found in every Canadian province. In 2001, 80.7 percent of beef cows originated in Prairie Canada — 43.7 percent from Alberta alone.² Dairy cows are concentrated mainly in Quebec and Ontario, and their bull calves are also raised for slaughter.

Within months of birth, calves are dehorned to prevent injury, vaccinated to prevent common bovine diseases, and bull

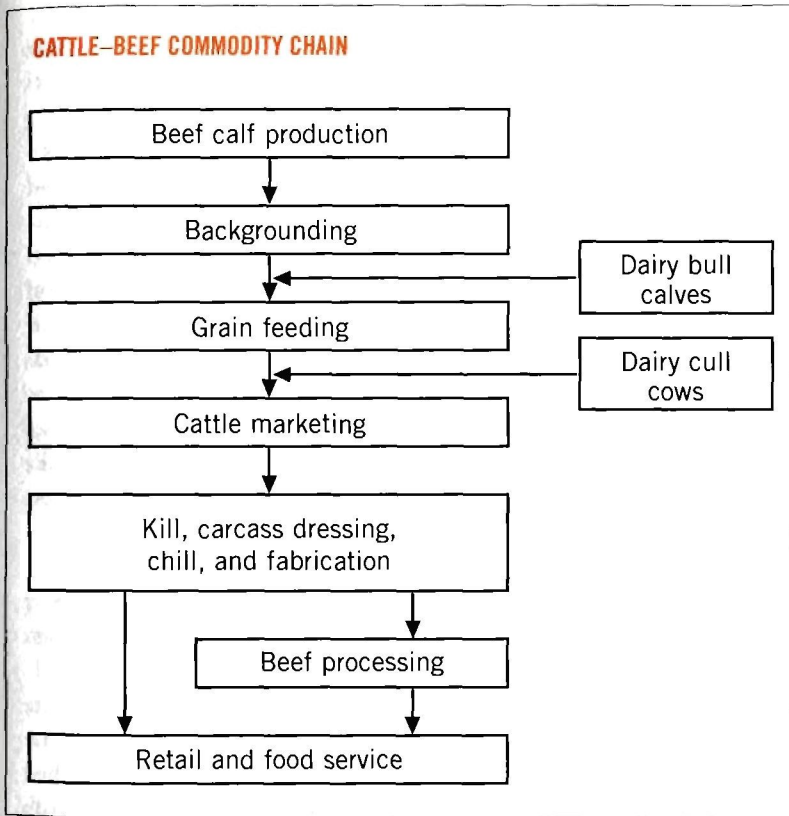
calves are castrated to prevent the development of masculine characteristics. Growth hormones are commonly administered to beef calves, usually as an implant in the outer ear, a body part that never enters the human food chain. Growth hormones help cattle to reach market weight sooner and reduce feed costs by increasing feed efficiency. In North America, it is believed that the concentration of hormones in the beef of treated cattle is

WITHIN MONTHS OF BIRTH, CALVES ARE DEHORNED TO PREVENT INJURY, VACCINATED TO PREVENT COMMON BOVINE DISEASES, AND BULL CALVES ARE CASTRATED TO PREVENT THE DEVELOPMENT OF MASCULINE CHARACTERISTICS.

minute relative to the natural background level of hormones in the human body, and that they pose no health risk to consumers. Nevertheless, the European Union has banned the import of beef produced using growth hormones, effectively shutting Canada out of European beef markets.

Backgrounding, the second phase in cattle production, starts with weaned calves. Standing grass in summer and sun-cured hay in winter provides the nutrients required for them to grow out and build the skeletal frame of mature animals. It is the most land-intensive production phase of the commodity chain, and producers must manage grassland carefully to prevent over-grazing and secure sufficient winter-feed.

Grain feeding, the third phase, finishes animals to slaughter weight — about 1,200 pounds (540 kilograms) for heifers and 1,300 pounds (590 kilograms) for steers. In Ontario and eastern Canada, this is often a small-scale winter enterprise on mixed farms. In Alberta, cattle finishing takes place on specialized feedlots containing 10,000 to 20,000 head, though some are



much larger. New arrivals receive a hay ration that is gradually stepped up to about 80 percent grain. In Ontario, the principal grain is corn while Alberta's cooler climate and shorter growing season make barley the feed of choice. Alberta dominates the industry; on January 1, 2003, it accounted for 63.5 percent of Canada's total beef cattle on specialized feeding operations.³

Finished cattle are shipped to the packinghouse by live-stock trucking firms in cattle-liners, large aluminum semi-trailer trucks. Most cattle are sold direct to the packer. Pricing systems

are complex and may be based either on liveweight or carcass weight. Prices are often negotiated as forward delivery contracts for truckload lots, months in advance of delivery.

Slaughter plants receive cattle on a just-in-time basis, seldom holding live animals for more than a few hours, providing time for ante-mortem inspection by a veterinarian. Alberta kill plants tend to specialize in the highest-quality grain-fed steers and heifers. In Quebec, the largest packing plants process spent cows culled from the dairy herd, which are used for ground beef and processed meat products. In older and smaller plants, cattle are stunned unconscious one at a time in a traditional “knocking box.” But in most large-scale facilities, there is a continuous-flow style of humane slaughter. Cattle walk calmly into the plant, gradually straddling a conveyor that lifts them gently off the floor. They glide calmly along the moving rail, oblivious to the impending blow from a pneumatically powered stunner that will cause sudden and immediate unconsciousness.⁴ The insensible animal is shackled and slowly rises to the bleeding rail for exsanguination. The feet are cut off with powerful hydraulic shears and the carcass is suspended from a gambrel that slides along an overhead rail for removal of the hide and head. The abdominal cavity is opened to remove the viscera, and the carcass is then split into two sides. Conveyor tables carry pans of viscera in synch with the carcass until meat inspectors have examined the critical organs and lymph nodes and are satisfied there is no evidence of disease. Suspect and randomly selected carcasses are subject to in-plant swab tests and laboratory analysis of various tissues to identify antibiotic or hormonal residues and a variety of other contaminants. After final trimming to remove any visible contamination, bruises or lesions, the carcass is transferred to the cooler where Canadian Beef Grading Agency staff assign a carcass quality grade depending on age, meat texture, and marbling. Once again, Alberta dominates,

accounting for 68.5 percent of Canada's reported cattle slaughter in 2002.

Large-scale beef dressing lines in state-of-the-art plants are designed to avoid the potential for cross-contamination, which has been recognized as a food safety hazard since the nineteenth century.⁵ The "hide-off area" of the kill floor is segregated from the "hide-on area," which is prone to manure splash from dirty hooves and hides. All cutting tools must be immersed in scalding water between each animal on the line. At some workstations, direct contact with blood or viscera is unavoidable. For these workers, there are long rubber aprons and high boots. Between each animal on the line, the worker steps into a clear plastic shower booth equipped with water jets to remove all trace of the previous carcass before the next in line is handled. The largest beef dressing plants are also equipped with massive steam pasteurization chambers that use scalding steam to kill any pathogens inadvertently transferred to the surface of the carcass during processing.

Fabrication or carcass-breaking divides the side of beef into smaller primal cuts (hip, sirloin, short loin, rib and chuck), each of which is subsequently carved into subprimal cuts. The various cuts are sorted into standard lots, vacuum-sealed in plastic film and packed in cartons, labelled to indicate the name of the cut and the source of the beef. Boxed beef is shipped in refrigerated semi-trailer trucks as soon as possible to minimize the time that it must be held in the plant's cold storage warehouse. Much of the output is destined for the distribution centres of supermarket and fast food chains while the remainder is sent to manufacturers for further processing into specialty meat products and individual portion-controlled servings for institutional and commercial kitchens.

As one might expect of an intensely competitive and entrepreneurial industry, the basic commodity chain has many variants. The tendency to specialize in just one link of the chain is offset by

the propensity to integrate forwards or backwards, and take some degree of control and profit over adjacent activities. Some parts of the chain have become fully integrated and co-located. For example, cow-calf producers may also background their weaned calves while Lakeside Packers of Brooks, Alberta, operates a feedlot across the highway from its kill plant, providing an in-house source for slaughter cattle.

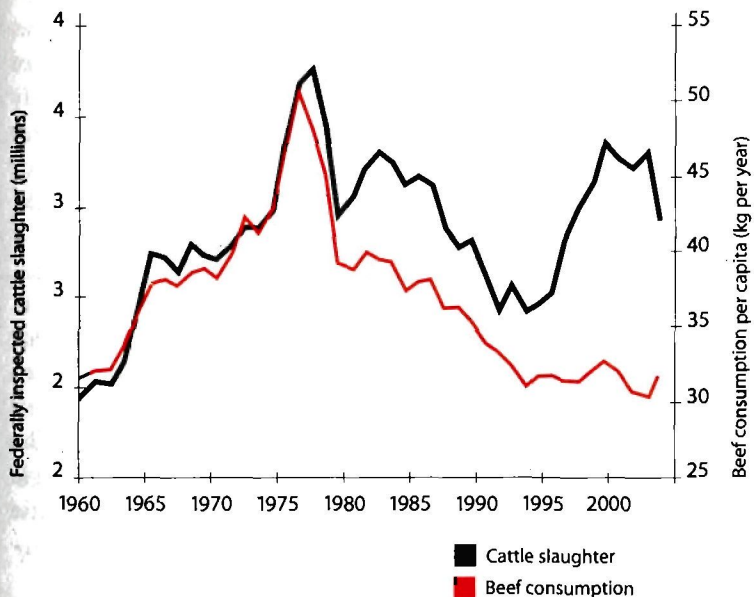
Like many other resource processing industries, meat packing restructured dramatically in the 1980s and 1990s. Meat packing shifted westward to follow cattle production, which has become strongly concentrated in Alberta. Canada Packers and Swift Canadian, the packinghouse leaders of the mid-twentieth century, gradually withdrew from the production of fresh commodity beef as a new beef processing duopoly emerged:

- Cargill Foods of High River, Alberta, a wholly-owned subsidiary of Minnesota-based Cargill, a global food processor and grain trader.
- Lakeside Packers of Brooks, Alberta, a wholly-owned subsidiary of South Dakota-based Tyson Fresh Meats, the world's largest beef and pork supplier.

These two plants account for 80 percent of Canada's capacity for slaughtering heifers and steers.⁶ While the industry leaders have changed, the meat-packing sector retains its high level of market concentration.

As trends in domestic beef consumption became uncoupled from domestic cattle slaughter, exports of boxed beef increased impressively in the 1990s with the United States accounting for 80 percent of beef exports. Canadian beef also made inroads further afield with notable success in Mexican, Japanese, and South Korean markets. Canada's beef competed favourably on quality and price while the government assured consumers that Canada was free of BSE.⁷ By 2003, 20–25 percent of the Canadian cattle

CANADIAN BEEF CONSUMPTION AND FEDERALLY INSPECTED CATTLE SLAUGHTER



Source: Agriculture and Agri-Food Canada *Livestock Market Review* (various years) and Statistics Canada Cansim II Series V108859, Table 20011, Apparent per capita food consumption in Canada (1960–2003)

This graph illustrates the divergence and gradual uncoupling of cattle slaughter from domestic beef consumption that began in the early 1990s. During the 1960s Canada's federally inspected cattle slaughter grew rapidly to meet the rising consumption of beef by Canadian consumers. Consumption peaked in 1976 and has since declined almost continuously, as did cattle slaughter until about 1990 when the relationship broke down. Divergence shows that the Canadian cattle and beef commodity chain has become uncoupled from domestic demand while live cattle and boxed beef exports have grown in significance. Canadian consumer

preferences were less relevant to an industry that became increasingly reliant on exports.

The year 2003 marks a stunning discontinuity as the series suddenly converge, a perverse outcome of the uncoupling of slaughter from consumption. Slaughter has dropped precipitously as Canada's cattle inventory rose to an all-time high. Consumers responded enthusiastically to lower prices in a spirit of support for cattle producers and increased their beef consumption, highlighting the elasticity of its demand.

sold in a typical week were exported live, on the hoof for slaughter in the United States.⁸ Export markets gave leverage to producers when they bargained with Canadian packers but left the producers vulnerable to U.S. trade policy on livestock. The worst-case scenario was realized on May 20, 2003, when a single case of BSE was confirmed and all of Canada's beef and cattle export markets slammed shut within hours.

BOVINE TUBERCULOSIS: THE ENIGMATIC ZOOONOSIS

Long before the discovery of BSE, government regulation of cattle imports and the domestic meat supply was influenced by the prevalence of other zoonoses, animal diseases such as tuberculosis that can be transmitted to humans. TB was responsible for an estimated one-third of all deaths from disease in Victorian Britain.⁹ It had been recognized as a killer of the urban poor for centuries but its contagious character was not grasped until 1865, and the tuberculosis bacterium was not isolated and identified until 1892. By the time of Britain's first Royal Commission on Tuberculosis in 1895, it was believed that bovine TB posed a threat to humans. But the level of risk and the procedures that should be followed when tuberculosis was detected were unclear

and would become increasingly controversial. Could humans contract TB by eating beef from infected animals? What degree of tuberculous infection was tolerable in a beef carcass? If a valuable beef carcass was to be condemned in the interest of public health, should the butcher be compensated by the state? After three "science-based" Royal Commissions, there was still uncertainty. We now know that raw milk, not beef, is the major vector of bovine TB.¹⁰

By the 1960s, Britain's eradication program had been so effective that Britain's cow-herd was declared tuberculosis-free. However, in the mid-1990s, the incidence of bovine TB began to increase and spread. The cause of this resurgence is unclear but wild badgers are the most likely culprits. The efficacy of badger culling is questionable and hotly contested (Donnelly 2003). Science still cannot provide the certainties that farmers and consumers would like. Britain's experience shows that after decades of claiming that bovine TB was effectively eradicated, it has reappeared with no consensus on the best method to control its spread.

Canada, too, has been attempting to eradicate bovine TB for many decades. But sporadic cases still appear during post-mortem inspection. Infected herds are typically quarantined and the cattle destroyed. While the Riding Mountain area of Manitoba is the only area of Canada *not* considered free of bovine TB, isolated cases are still discovered elsewhere, and in March 2004, bovine TB was discovered near Steinbach, Manitoba, outside of the Riding Mountain Eradication Area. In Canada, cervids, such as elk and mule deer, are the most likely source of infection, but reservoirs of TB may be found in any warm-blooded vertebrate community. It is especially difficult to control, given the spatial extent of Canada's grassland and its availability as cervid habitat. As in Britain, cattle producers have called for an aggressive cull of the elk population, and, as in Britain, the effectiveness of such a cull has been challenged.¹¹ The dynamics of

bovine TB transmission are still poorly understood,¹² but there is considerable evidence of the growing threat to human health posed by multiple-drug resistant strains of the TB bacterium.

POLICY FAILURE: THE CASE OF BSE IN THE UNITED KINGDOM

Given the enigmatic nature of TB after a century of research and concerted efforts to eradicate the disease, it is no surprise that bovine spongiform encephalopathy (BSE) is not completely understood either. The agent that causes BSE is a prion, a self-reproducing proteinaceous infectious particle that did not conform to any of the prevailing models of microbiology when it was hypothesized as the cause of sheep scrapie in 1982. The prion was named and discovered by Dr. Stanley Prusiner who lost his research funding and was in danger of not being awarded tenure at the University of California at San Francisco. Virologists treated his revolutionary hypothesis with enormous skepticism when it was first proposed.¹³ Fifteen years later, Dr. Prusiner was awarded the Nobel Prize in Medicine for discovering the prion, which we now know is associated with BSE. The discovery of the prion shows how recent scientific developments shape our understanding of the cause of BSE; it also underscores the contentious nature of scientific progress.

BSE was identified in November 1986 after a cow's abnormal behavioural symptoms were first recorded in December 1984. Britain's Ministry of Agriculture, Food and Fisheries (MAFF) did not know if BSE was transmissible to humans. There was no evidence. While absence of evidence is not evidence of absence, the government assured the British public, repeatedly and authoritatively, that British beef was safe, and that BSE was *not* a danger to human health. The link between BSE and variant Creutzfeldt-Jakob disease (vCJD)¹⁴ was denied for nine years. Meanwhile, a natural experiment was in progress that would last

until the incubation period (itself unknown) provided epidemiologists with sufficient data to draw a conclusion. Exponential growth in the number of reported cases of BSE in cattle was undeniable. There was a growing *apprehension* of a link between BSE and vCJD. But without a smoking gun, Britain's MAFF took little heed of the limited bits of evidence that were becoming available. Instead, the primary concern of MAFF was the negative, indeed catastrophic, impact that public knowledge of BSE would have on Britain's cattle and beef exports.¹⁵

Thus the British public was taken completely by surprise in March 1996 when the government made a stunning volte-face. Ten cases of vCJD in people under the age of forty-two had been confirmed, and while there was still no proof that BSE could be transmitted to humans by eating beef, the most likely explanation

BRITAIN'S CATASTROPHIC EXPERIENCE WITH BSE HAS ERODED PUBLIC TRUST IN THE AGRO-INDUSTRIAL COMMODITY CHAIN THAT CHANNELS THE FOOD SUPPLY TO THE SUPPER TABLE.

was that those cases were linked to exposure to BSE before specified bovine offal products (brain, spinal cord, spleen, thymus, tonsils, and intestines) were banned for human consumption in 1989. Seven days later, the European Union prohibited the export of all live cattle and beef products from the U.K. In an effort to eradicate the disease, Britain belatedly announced that no cattle over the age of thirty months would enter the food or animal feed chains.¹⁶

By July 30, 2004, a total of 142 deaths had been attributed (definitely or probably) to vCJD in the U.K. Annual vCJD mortality increased rapidly but epidemiological research suggests that Britain's vCJD epidemic is nearing its peak.¹⁷ Only one

death has been attributed to vCJD in Canada; it appears likely that the victim contracted the disease during multiple visits to the United Kingdom.¹⁸

Britain's catastrophic experience with BSE has eroded public trust in the agro-industrial commodity chain that channels the food supply to the supper table. The challenges posed by BSE were not unique — similar dilemmas were raised when the hazards of bovine tuberculosis were first recognized in the nineteenth century. Yet it seems that regulators and policy makers were no better able to manage scientific controversy and technical uncertainty in the 1990s than they were in the 1890s. Science is a process, not a pat answer with a single objective truth. Scientists do not always agree and their findings can be ambiguous or even contradictory. In the case of BSE in Britain, scientific claim-makers divided into in-groups — whose findings were declared credible and politically sound — and out-groups — who advocated precaution, but without access to research material to pursue their unpopular views.¹⁹ Recent calls for policies, which are simply “science-based,” do not recognize the complexity, uncertainty and contingency of scientific research, let alone the awesome problem of risk in decision-making. Experience with bovine tuberculosis since the nineteenth century suggests that it may be unwise for policy makers to prevaricate until the scientific process has finally yielded complete and unambiguous answers.²⁰

ONE IN A MILLION: CANADA'S NEWEST FOOD-BORNE ZOOONOSIS

Eleven months after the detection of BSE in May 2003, the Canadian Senate's Standing Committee on Agriculture and Forestry investigated the situation, “to explore potential solutions, *with the aim of preventing the recurrence of such a disaster.*” True to its agricultural mandate, it emphasized the tragic consequences of trade disruption for farm communities, but gave no attention to

the challenge of risk management. The committee concluded:

The reopening of the US border is vital to the industry's survival, and the Committee wants the government to pursue its efforts to convince the United States that it is in the best interests of North America as a whole to show leadership to the rest of the world in resuming trade *based on scientific grounds*.²¹

The Senate Committee heard from "stakeholders from the entire beef chain," including farmers, packers and retailers, the Minister of Agriculture and Agri-Food, bureaucrats from Agriculture and Agri-Food Canada and the Canadian Food Inspection Agency (CFIA), representatives from each prairie province's association of rural municipalities, and the Chief Veterinary Officer for Canada. Of twenty-seven witnesses, only *one* was a veterinarian, and not a single microbiologist, epidemiologist, animal scientist, or food scientist was identified on the witness list. Yet the Senate Committee advocated a resumption of trade *based on scientific grounds!* Like Britain's discredited MAFF, which was later restructured out of existence, the primary concern of the Senate's Standing Committee on Agriculture was the catastrophic impact of BSE, not the risk-management policies that were the ultimate cause of the crisis. Calls for science-based policy require that scientists have a seat at the table. By focusing exclusively on the economic disruption, the Senate missed the opportunity to ask more fundamental questions:

- Why did BSE appear in Canada?
- Why did the discovery of BSE take producers and consumers by surprise?

Until May 2003, the Canadian Food Inspection Agency insisted that Canada was "BSE-free." It was believed that bovine feed

ingredients from domestic animals posed “no measurable BSE risk to the health of Canadians.”²² This policy was maintained even though it was well known that hundreds of cattle from BSE-infected countries were imported into Canada between 1979 and 1993, one of which was confirmed to have BSE in 1993. Based on statistical analysis, the mean expected number of cases of BSE among the imported cattle was three, with twenty-four cases as the probable limit.²³ What were the chances that one of these imported BSE-infected animals was slaughtered or died between 1979 and 1997 (before the feed ban), its carcass subsequently rendered to produce animal feed causing another animal to become infected with BSE? The estimated probability of at least one infection of BSE occurring prior to 1997 was calculated to be 0.0073, about seven chances in a thousand.²⁴ The CFIA concluded that the likelihood of establishment of BSE in cattle in Canada prior to 1997 was negligible. But two cases originating in Canada were discovered in 2003. Either Canadian cattle producers were extremely unlucky or the risk factors are still not understood.

Professor William Leiss, one Canada’s foremost experts in the field of risk communication, argues that the estimated probability assessment ignored the consequences — thus it was not measuring risk at all. Risk is properly calculated as the probability times the consequences. Despite the remote probability, the consequences would be catastrophic for the cattle industry. The estimation of risk should be driven by the magnitude of the consequences as much as by the remoteness of the probability. Thus Leiss argues that the risk was far from negligible — indeed, the risk was “intolerable.”²⁵

Canada can no longer claim to be BSE-free. Health Canada’s “precautionary assumption” is that “there may be a low, previously undetected, BSE prevalence in Canada.”²⁶ By contrast, the CFIA declares, “the incidence of BSE in Canada is equivalent

to that of a minimal risk country.” Based on the Terrestrial Animal Health Code of the acknowledged authority, *l’Office international des epizooties*, the incidence of BSE in Canada is considered to be less than one in a million. Only one case of BSE has been detected during the last twelve-month period in a herd of approximately 5.5 million adult cattle.²⁷ Nevertheless, based on the recommendations of the international panel that was commissioned to review Canada’s response to the discovery of BSE, Food and Drug Regulations were amended to ban the sale or import of specified risk materials (SRM) for food in July 2003, fourteen years after Britain had banned the human consumption of specified bovine offal.²⁸

“I guess any self-respecting rancher would have shot, shovelled and shut up, . . .”

Ralph Klein, Premier of Alberta,
Western Governors’ Association annual meeting
in Big Sky, Montana, September 14, 2003

To maintain Canada’s current international standing as a “minimal risk” country and to stand a chance of restoring export markets for live cattle and beef from animals over thirty months old, the level of BSE testing will have to be greatly increased, especially among the older and higher-risk animals. Producers are reluctant to pay for veterinary treatment when older animals with little market value appear sick, and veterinarians may be unwilling to submit the head of euthanized livestock for testing due to the stigma attached to whoever triggers the next discovery of BSE in Canada.²⁹ According to the Fred Dunn, Alberta’s Auditor General, “No one wants to be that number three — that third case diagnosed here,” which is why some farmers may elect not to test high risk animals for BSE and just bury their dead cows.³⁰ But insufficient testing of high-risk animals could itself be grounds for a further downgrading in Canada’s BSE status by

l'Office international des epizooties. By July 27, 2004, it was still unclear how a sufficient number of samples would be gathered to meet Alberta's 2004 test quota.³¹ No one knows if a single case of BSE remains in Canada. Cattle producers are afraid to look for it but equally afraid that no one is looking for it, betting the farm whether they like it or not. Meanwhile consumers rely on government inspection to ensure that their meat is safe.

MEAT INSPECTION

Canada's Meat and Canned Foods Act became law in 1907, one year after publication of *The Jungle*, Upton Sinclair's sensational exposé of unsanitary food handling practices in Chicago's meat-packing plants.³² Canada's Meat Inspection Service was created as an agency of the Department of Agriculture. Any plant wishing to ship its products across provincial or international boundaries was obliged to meet federal inspection standards.

One important lesson gleaned from Britain's BSE crisis was the need to separate the government department that promotes and supports food commodity producers from the agency responsible for monitoring and enforcing food safety standards. Britain created an autonomous Food Standards Agency (FSA) in 2000, with a mandate to represent the public interest, and an independent board, which reported to Parliament through the Health Ministers. In addition to the accountability change, Britain's FSA adopted a remarkably transparent policy on the proceedings of its expert committees, giving its scientists an unusual degree of freedom to communicate dissenting views. Unorthodox and contrary scientific views and minority opinions are considered and documented so that there is a clear audit trail showing how committees reached their decisions. By exposing scientific uncertainties and clearly identifying the very real policy dilemmas of what is both a scientific and a political process, the

FSA is attempting to avoid further policy failures of the type that characterized Britain's handling of BSE.³³

Wisely anticipating the structural problem revealed in the United Kingdom's BSE experience, Canada took pre-emptive action. The Canadian Food Inspection Agency (CFIA) was formed in 1997 to consolidate the delivery of all federal food, animal and plant health inspection programs — programs that had formerly been provided through four federal government departments: Agriculture and Agri-Food Canada, Fisheries and Oceans Canada, Health Canada, and Industry Canada. While the CFIA still reports to parliament through the Minister of Agriculture and Agri-Food, it stands at arm's length from the department that promotes agricultural output and international trade in food products.

Given the importance of its mandate and the challenging policy questions that it is likely to face, the CFIA may require even greater autonomy, with a board structure that gives science more seats at the table, as in Britain's FSA. Such a board would include private sector "stakeholders" from various agri-food sectors, but it should also have strong representation from veterinarians, and food, animal, fish, and plant scientists to bring an independent scientific perspective to bear on emerging food safety issues and the close relationships between animal and human health questions.³⁴ Like an auditor, the CFIA would benefit from a more independent structure. Government scientists should be given the freedom, sometimes called "whistle-blower" protection, to articulate dissenting views on the unprecedented food safety challenges emerging from industrial agriculture, innovative biotechnologies, a global food economy, and advances in health research.

Protocols for Quality Assurance

Traditional organoleptic meat inspection detects disease with the five senses, using techniques such as visual examination, incision, and palpation of various organs and lymph nodes. It is little

changed since these techniques were first developed in the 1880s. Except for the grossest abnormalities, organoleptic inspection is of doubtful sensitivity, and procedures such as incision have been known to spread pathogens.³⁵ Considering that many recently identified bacterial and viral pathogens are not detectable by organoleptic methods, British veterinarians argue that the analysis and management of risk in the slaughter and carcass

HAZARD ANALYSIS CRITICAL CONTROL POINTS

Hazard Analysis Critical Control Points (HACCP, pronounced "hassip") is widely acknowledged as the standard quality assurance protocol to monitor processes for safety in the food and beverage industries. HACCP was first developed by the Pillsbury Company in 1960 to attain the 100 percent quality assurance level required to feed astronauts in NASA's space program.

To implement the procedure and become eligible to claim HACCP compliance, it is necessary to work through a seven-point process, beginning with hazard analysis and identification of the critical control points, the stages in any process where hazards exist. Procedures to measure, monitor, correct, and document the hazards and preventative actions are developed. HACCP is an unapologetically bureaucratic system that relies on measurement and documentation to integrate quality assurance into every phase of production.

While HACCP can reduce risk, it is no guarantee. For example, Excel Beef (the beef producing arm of Cargill Foods in the United States) is HACCP accredited, but in December 2003 it had to recall 13 tons of ground beef labelled as "irradiated for food safety." For nearly three months the ground beef had not, in fact, been irradiated at all. Even in HACCP certified plants, errors may persist for prolonged periods.

dressing process should become the key functions of meat inspection.³⁶ The most common technique for risk analysis in meat production is Hazard Analysis Critical Control Points (HACCP). Many of the largest meat packing firms have already developed sophisticated new quality assurance systems based on HACCP on their own initiative. HACCP certification will eventually be mandatory in all federally inspected meat plants, as is already the case in federally registered fish and seafood plants.

The emphasis in traditional meat inspection was on ante-mortem physical condition of livestock, and post-mortem carcass dressing and meat processing — but there are possibilities that food safety may be compromised elsewhere in the commodity chain, both ante-mortem and post-packaging. Ante-mortem inspection in the pen is usually brief and arguably less important in determining suitability for slaughter than an assessment of the disease and treatment history of the animal when it was on the farm.³⁷ The farm is the source of many animal diseases, injuries, and other food safety hazards such as excessive tag,³⁸ broken hypodermic needles, and failure to observe specified withdrawal times after pharmaceutical treatment. Numerous critical control points in livestock production may create hazards. Feeds derived from rendered ruminants are now recognized as a serious hazard. This demands a new awareness of critical control points, both at the commercial feed mill, where rendered ingredients must be conscientiously segregated, and in the barn, where different types of feed may be stored. Post-production quality assurance is no less essential, from loading boxed beef on the reefer truck through retail and on to the restaurant or household kitchen. The *E. coli* O157:H7 bacterium originates on the farm, becomes a contaminant in the packing plant, multiplies if meat is improperly stored, but can be neutralized in the kitchen if beef is properly cooked.

The “farm-to-fork” concept refers to quality assurance programs that flow through the length of the commodity chain. To

address food safety concerns, HACCP-style quality assurance systems need to be applied at every step in the commodity chain, beginning with calving, extending through ante-mortem inspection at the slaughterhouse-door, all the way to the consumer. Farm-to-fork quality assurance will be facilitated by the Canadian Cattle Identification Program, which was inaugurated in 2001. All cattle that move beyond their herds of origin must now have uniquely coded ear tags that remain in place up to the point of carcass inspection at the packing plant.³⁹ The ability to trace animals backward to their herd of origin, or forward when a herd becomes dispersed, provides an unprecedented level of information for tracing the spread of animal disease and meat safety hazards from farm to fork.

Many producers have accepted voluntary programs such as the Canadian Cattlemen's appropriately named "Quality Starts Here," which promotes best practice, but does not monitor it.⁴⁰ In Britain, the major supermarket chains sell only "Farm Assured British Beef and Lamb," a quality assurance certification program that requires producers to be inspected and subject to audits.⁴¹ Mandatory compliance with on-farm quality assurance programs is the next logical step in Canada, but will be opposed by producers who guard their independence and object to HACCP as a bureaucratic burden.⁴² Farmers will only accept quality assurance protocols when retailers send a clear market signal up the commodity chain, making certified and verified quality assurance a condition of market access.

Provincial Meat Inspection and the Regulatory Paradox

Provincially licensed slaughter plants may only sell meat within their home province. Cattle slaughter in provincially licensed plants amounted to 185,000 head in 2002 or about 6 percent of Canada's total reported cattle slaughter.⁴³ Large-scale federally inspected meat suppliers regard the provincially inspected meat plants as marginal and irrelevant to Canada's large export-oriented

meat-packing sector. This is a fallacy with serious consequences. What happens in provincially inspected plants does have an impact on large-scale producers and their export markets. The “single stinking cow” that triggered the BSE crisis, according to Premier Klein, was sent to a provincially inspected plant and the animal’s head languished on the laboratory shelf for over three months before it was finally examined and BSE was detected.

“It was just one stinking cow, . . .”

Ralph Klein, Premier of Alberta,
Pacific Northwest Economic Region annual summit,
Calgary, Alberta, July 14, 2003

Since its inception in 1907, federal meat inspection legislation has excluded farm slaughter and the intraprovincial meat trade from its provisions. This had the effect of reserving the higher-quality cattle and hogs for export markets while the lowest-quality cattle went to domestic consumers. Hundreds of small slaughterhouses served local butcher shops, seldom subject to any inspection. As early as 1918, the Livestock Commission of Saskatchewan noted the problem with selective federal standards.

At present inspection operates only in those plants which do an interprovincial business, though it covers all products of such establishments, whether sold locally or outside. The consequence is that the worst stuff is reserved for local killing and consumption. Some districts notorious for bad stock are avoided by inspected plants, only to find an outlet locally.⁴⁴

The regulatory paradox is that when two sets of regulations are applied, the highest-quality goods, which are likely to meet the criteria, are directed to the most demanding regulator, while the lower-quality goods are dispatched to the less onerous regulatory

regime. As standards in Canada's federally inspected plants rise, and plants become more comprehensively equipped to meet demands for food safety, the smaller provincially inspected plants may be left to handle the higher-risk livestock.

Dr. Temple Grandin, the leading animal scientist in the field of humane livestock handling and slaughter, audited Canadian slaughter practices in 1995, 1999, and 2003. Noting the distinction between federal and provincial plants, Grandin did not observe any sick, debilitated or emaciated animals in federally inspected plants in 1995. She went on to argue that "downers" (livestock which cannot stand) and "cripples" have not been miraculously healed; they are simply being diverted to smaller plants, which are not federally inspected.⁴⁵ Canada's Health of Animals Regulations prohibit loading or transport of downers. But every province has its own animal health legislation, which does not always provide for the humane transportation of animals. Most provinces have only broad guidelines, so the handling of downers and sick livestock varies from province to province.⁴⁶ On January 13, 2004, the CFIA banned the slaughter of downer cattle in federally inspected plants licensed for export. This interim measure was designed to harmonize Canada's BSE risk management measures with those in the U.S.A. in an effort to maintain market access.⁴⁷ The effect of the CFIA ban is to divert downer cattle to provincially inspected plants for the domestic food chain. Thus provincial inspectors in small and sometimes remote plants may have to make a proportionally larger number of critical animal health decisions, but with less direct, onsite access to veterinary support than is the case in federally inspected plants.

In 1995, Dr. Temple Grandin expressed reservations about Canada's provincially licensed plants.

There is a need to review practices in provincial plants that are not federally inspected or members of the Canadian

Meat Council. It is likely that bad things are going on in some small provincial plants. I have learned from experience that very small plants come in two basic types. They are either excellent or disgusting.⁴⁸

Many of the provincially inspected slaughter plants that I have observed are cheerful family-owned businesses with conscientious owners and skilled workers. But few are equipped with the state-of-the-art equipment for carcass pasteurization and sanitation of cutting tools found in large plants. And I have also witnessed ineptitude and inhumane practices in provincially inspected facilities. In one case, I noted that six bullets had to be fired from a single-shot .22 calibre rifle before a steer was finally stunned into

IN ONE CASE, I NOTED THAT SIX BULLETS HAD TO BE FIRED FROM A SINGLE-SHOT .22 CALIBRE RIFLE BEFORE A STEER WAS FINALLY STUNNED INTO INSENSIBILITY.

insensibility. While stunning effectiveness is not a direct measure of meat safety, it is a determinant of meat quality.

The 2001 Report of the Provincial Auditor of Ontario observed critical deficiencies in its provincially inspected meat plants. Hazards to human health included ineffective sanitizing equipment, carcasses transported in unrefrigerated trucks, and unsanitary food contact surfaces. Ontario's Ministry of Agriculture, Food and Rural Affairs was slow to verify that corrective action was taken when abattoirs were not in compliance with food safety regulations, meat inspectors' documentation was insufficient to demonstrate that operational tasks were actually being completed, and there was no procedure for random laboratory testing to detect evidence of contaminants in the meat produced in

provincial plants.⁴⁹ In August 2003, a provincially inspected plant in Aylmer, Ontario was investigated for the alleged sale of uninspected meat, slaughtering without a provincial inspector present, and processing of dead stock. No charges were actually laid, but the allegations were widely reported. Between 1991 and 2003 the firm's licence was provisionally suspended five times and on two other occasions the firm was warned about illegal slaughter and obstructing a meat inspector.⁵⁰

These events prompted a judicial inquiry into meat regulation and inspection in Ontario. Among other problems in the provincial inspection system, Justice Roland Haines found evidence of nepotism in the appointment of meat inspectors, and pointed to deficiencies in their qualifications and training after provincial government cutbacks had replaced permanent inspectors with part-time contractual appointees.⁵¹ He also identified conflict of interest as an issue. Unlike the Canadian Food Inspection Agency, which operates at some remove from Agriculture and Agri-Food Canada, provincial meat inspection is typically a function within provincial ministries of agriculture.⁵² Thus provincial inspection authorities may feel torn between their responsibilities to consumers and their active support of livestock producers. In Ontario, Justice Haines found evidence of, "a reluctance to act decisively when the issues of public safety and client welfare collide. This only fuels the perception that public safety is sometimes taking a backseat to the agricultural business."⁵³

Provinces such as Ontario claim that provincial inspection standards are equivalent to federal food standards, and that the difference between federal and provincial inspection is primarily one of scale and scope, not food safety outcomes.⁵⁴ Notwithstanding their equivalent inspection standards, provincially inspected plants are typically not as well equipped with state-of-the-art sanitation equipment, and are not as well designed and constructed to prevent contamination. The qualifications, training, and experience of

provincial inspectors varies from one province to another, as does the frequency and intensity of support by professional veterinarians. At the retail meat case and in commercial or institutional dining rooms, it is often unclear whether meat was provincially or federally inspected, and it is difficult to discover where it was slaughtered and processed.

Many Canadians prefer to buy meat from locally produced livestock, and there is growing interest in organic and natural meat products, community-supported agriculture, and alternative farming practices. This trend should reinforce the role of small-scale, locally oriented slaughter plants in the commodity chain. The friendly, small-town butcher, operating a small provincially inspected plant, provides a valued alternative to national chain stores and large scale meat-packing plants. But the friendly butcher may also be processing older livestock that are more likely to be disabled or to have some zoonotic infection. Experience with locally oriented kill plants suggests that small is not always beautiful, and provincially licensed slaughter plants may need more intensive quality assurance than is presently the case.

The smaller abattoir environment poses unique challenges to meat inspection, given the prevalence of part-time kill floors that operate only one day per week, staff who are only intermittently employed in slaughter and carcass dressing tasks, and part-time meat inspectors. Some provincially inspected abattoirs are in peripheral regions, making it difficult to provide immediate support from professional veterinarians. Given the growing importance attached to food safety, the rapid developments in the biotechnology of meat inspection, and the important role played by smaller meat plants, would Canadians be better served by one rationalized system of meat inspection instead of eleven? Can we still justify two classes of inspection, one of which is *not* eligible for export and *not* acceptable for most fast-food and supermarket chains, yet satisfactory for domestic consumers?

Can more effective methods of meat hygiene and risk management be developed specifically for the needs of small plants?

BETTING THE FARM IN RISK SOCIETY

Sociologist Anthony Giddens, Director of the London School of Economics, has identified the politics of risk as one of the most distinctive aspects of modern society. Risk is an evaluation of a hazard — often quantified as a probability — that may materialize in the future. A concern with uncertain future events, justifying institutions such as fire departments, is among the hallmarks of modernity. Why has risk become so important? Modern society

MODERN SOCIETY HAS A CAPACITY TO CREATE “MANUFACTURED RISKS” ON AN UNPRECEDENTED SCALE.

has a capacity to create “manufactured risks” on an unprecedented scale. Unlike the chances of being hit by lightning (a natural hazard with an improbable but quantifiable risk), we have no idea of the likelihood of our manufactured hazards. Cassandras warn of sea level rise or bacterial resistance to antibiotics as catastrophic outcomes of anthropogenic global change. What is the risk that one of these post-modern plagues may be visited upon future generations? Civil society does not know, and scientists do not agree. Thus Giddens says that there is a new “riskiness to risk” creating “a new moral climate of politics” in our “risk society.”⁵⁵ Politicians are charged with a cover-up if they elect not to take action and the worst-case scenario materializes. And if they take action against a non-existent menace, they are charged with scare-mongering. Science-based policy-making

can't always win — that is the fundamental problem posed by risk society.

One way to resolve this problem is to apply the “precautionary principle,” a risk management tool which states that a lack of full scientific certainty should not be used as a reason for postponing decisions.⁵⁶ The precautionary principle is written into the Treaty of Maastricht, and adopted by all member countries of the European Union. To avoid the risks posed by growth hormones, the EU applied the precautionary principle in its continuing ban on Canadian and American beef imports.⁵⁷ Among most Canadian cattle producers, this use of the precautionary principle is perceived as a hypocritical pretext for a protectionist trade policy that discriminates against Canadian beef. These trans-Atlantic differences illustrate polar opposites in the moral climate of politics described by Giddens.

The precautionary principle has also been adopted by the Canadian Food Inspection Agency and by the Canadian government at large.⁵⁸ Yet applying the principle to decision-making is challenging because there is no consensus in the public's perception and tolerance of risk. Instead there is a broad plurality of risk preferences. Risk preference plurality poses a conundrum for policy-makers trying to discern whether “risk of serious harm” is truly credible. William Leiss argues that the risk of BSE was clear:

Trouble has been brewing for Canada's beef industry for many years, during which both political and industry leaders followed the well-known three monkeys' routine (“hear no evil . . .”). The bottom line is, Canada — with a \$30 billion annual beef industry to protect — has been appallingly lax in its policies designed to minimize BSE risk. In more technical language, we have been insufficiently precautionary, by a wide margin, in response to the *economic risk* represented by BSE.⁵⁹

In the area of BSE policy, Canadians behaved as daring risk-takers. Canadians bet the farm, counting on denial and long odds to escape calamity. Canada came up short, and all Canadians are paying the price. If Canadians are fundamentally risk-averse, given that the stakes are so high, then we need to recognize that we are living in risk society and start applying the precautionary principle more consistently from farm to fork.

Glib assertions that policy decisions should be “science-based” ignore the essentially political character of risk assessment. Science and politics must interact, so that the ambiguities of scientific findings and the subtleties of scientific judgment may be communicated and shared with consumers in the climate of uncertainty that characterizes our risk society.

In coping with challenges at every stage in the commodity chain, cattle producers, beef packers, and government regulators have already demonstrated enormous ingenuity, showing evidence of innovation at every step. This chapter points to some areas where further innovation seems warranted and likely in the near term. None of these proposals is truly novel, and initiatives are already underway to address each of them; however, progress has been glacial.

- Give the CFIA and provincial meat inspection agencies greater autonomy both in their relationship to agricultural interests and internally, perhaps with a board structure that brings scientific perspectives to bear on “science-based” regulatory questions.
- Examine provincial meat inspection from a nation-wide perspective and consider some nation-wide benchmarks. Consider creative ways to implement higher national standards yet retain the essential character of small-scale meat plants.
- Extend quality assurance programs from “farm to fork.”
- Use the precautionary principle, and assess risk as the product of probability and consequences to avoid future zoonotic catastrophes.

02. BETTING THE FARM: FOOD SAFETY AND THE BEEF COMMODITY CHAIN

While food safety issues are changing rapidly, the challenges and ambiguities of decision-making under uncertainty will always be with us. To manage food safety risks wisely, in a dynamic policy environment, we must involve scientists more directly in decision-making processes. And we must avoid simplistic calls for science-based policy when there is disagreement, using appeals to science to validate the status quo. As Canada learned to its cost, we could be betting the farm: the odds may seem good but the consequences could be catastrophic.

NOTES AND ACKNOWLEDGEMENTS

Chapter 2

BETTING THE FARM: FOOD SAFETY AND THE BEEF COMMODITY CHAIN

1. Verna Mitura and Lina de Piédro, *Canada's Beef Cattle Sector and the Impact of BSE on Farm Family Income 2000–2003*, Statistics Canada Agriculture Division Working Paper no. 69 (Ottawa, June 2004): 5.
2. Statistics Canada, *Census of Agriculture*, 2001.
3. Statistics Canada, Agriculture Division, special tabulations from “Cattle Statistics” Catalogue, July 2003, 23–012.
4. Temple Grandin, “Conveyor Restrainer,” <http://www.grandin.com/restrain/new.conv.rest.html>.
5. Experimentation showed that material from tuberculous lesions in the viscera (notably in the lungs, lymphatic glands, and liver) could contaminate otherwise wholesome meat by the hands, knives, and clothes of the butcher during the processes of flaying and dressing the carcass. See *Royal Commission Appointed to Inquire into the Effect of Food Derived from Tuberculous Animals on Human Health*, P.P. 1895, xxxv, 14.
6. The Honourable Donald H. Oliver, Q.C., Chairman, Senate of Canada, The Standing Committee on Agriculture and Forestry, *The BSE Crisis — Lessons for the Future*, Interim Report (April 2004): 10.
7. Canadian Food Inspection Agency, “Transmissible Spongiform Encephalopathies (TSEs) Questions and Answers,” February 5, 2001, http://www.inspection.gc.ca/english/anima/heasan/disemala/spong/tse_e.shtml.
8. Kevin Grier and Larry Martin, *Cattle Pricing and Other Contentious Industry Issues*, Special Report (Guelph: George Morris Centre, 2004), <http://www.georgemorris.org/PDF%20Files/GMCSpecialReport-BeefPricing031604.pdf>.
9. Anthony S. Wohl, *Endangered Lives: Public Health in Victorian Britain* (London: Dent, 1983), 130.
10. Keir Waddington, “The Science of Cows,” *History of Science* 39 (2001): 355–81.
11. Barry Wilson, “Eliminating Bovine TB Said Next to Impossible,” *The Western Producer*, March 10 2003, <http://www.producer.com/registered/articles/2003/0306/livestock/20030306ls05.html>; and Canada House of Commons Standing Committee on Agriculture and AgriFood, *Bovine Tuberculosis in the Immediate Area of Riding Mountain National Park in Manitoba* (April 2003), <http://www.parl.gc.ca/InfoComDoc/37/2/AGRI/Studies/Reports/agrip01-e.htm>.
12. F. D. Menzies and S. D. Neill, “Cattle-to-Cattle Transmission of Bovine Tuberculosis,” *The Veterinary Journal* 160 (2000): 92–106.
13. Nobel e-Museum, “Stanley Prusiner,” <http://www.nobel.se/medicine/laureates/1997/prusiner-autobio.html>.
14. Variant CJD (vCJD) is a rare degenerative brain disease that is invariably fatal with no known treatment. It is associated with the consumption of tissue contaminated by the active agent that causes BSE in cattle. The vast majority of cases have been in the United Kingdom and the average age at mortality is under 30. Classic Creutzfeldt-Jakob disease (CJD) is an invariably fatal degenerative brain disease of the elderly and is endemic worldwide. See <http://www.hc-sc.gc.ca/english/diseases/cjd/hg4.html> and http://www.cdc.gov/ncidod/diseases/cjd/cjd_fact_sheet.htm.

15. Patrick Van Zwaneberg and Erik Millstone, "BSE: A Paradigm of Policy Failure," *The Political Quarterly* 74 (2003): 30.
16. Unired Kingdom, *The BSE Inquiry Report*, vol. 6, chap. 7, 740–742, <http://www.bsainquiry.gov.uk/index.htm>.
17. National Creutzfeldt-Jakob Disease Surveillance Unit, University of Edinburgh, CJD Statistics, <http://www.cjd.ed.ac.uk/figures.htm>.
18. Health Canada, *First Canadian Case of vCJD* (May 2003), <http://www.hc-sc.gc.ca/english/diseases/cjd/index.html>.
19. Merle Jacob and Tomas Hellström, "Policy Understanding of Science, Public Trust and the BSE-CJD Crisis," *Journal of Hazardous Materials* 78 (2000): 309.
20. Keir Waddington, "Safe Meat and Healthy Animals: BSE and Bovine TB," *History and Policy*, <http://www.historyandpolicy.org/archive/policy-paper-04.html>.
21. Oliver, *The BSE Crisis*, 14.
22. Health Canada Food Directorate, *Policy on Specified Risk Materials (SRM) in the Food Supply* (2003), http://www.hc-sc.gc.ca/food-aliment/fpi-ipa/e_policy_srm.html.
23. Canadian Food Inspection Agency, "Risk Assessment on Bovine Spongiform Encephalopathy in Cattle in Canada, Part C: Risk Estimation," Section 3.1 Probability that the Imported Bovine Animal is BSE-Infected, December 2002, <http://www.inspection.gc.ca/english/sei/ahra/bseris/bserisc1e.shtml#Cfig2>.
24. *Ibid.*, Section 6.1 Risk Estimate, <http://www.inspection.gc.ca/english/sci/ahra/bseris/bserisc2e.shtml#Cfig5>.
25. William Leiss, "A Closer Look at CFIA's BSE Risk Estimation," BSE Risk in Canada, Part 4, 2004, <http://www.leiss.ca/bse/155?download>.
26. Health Canada Food Directorate, *Policy on Specified Risk Materials (SRM) in the Food Supply* (2003), http://www.hc-sc.gc.ca/food-aliment/fpi-ipa/e_policy_srm.html.
27. Canadian Food Inspection Agency, "Canada: A Minimal BSE Risk Country," December 2003, <http://www.inspection.gc.ca/english/anima/heasan/disemala/bseesb/minrisexece.shtml>.
28. In Canada the term "specified risk materials" (SRM) is now used to denote an expanded list of bovine by-products that contain the infective agent of BSE and are restricted from entering the human food supply. SRM include skull, brain, trigeminal ganglia of the skull, eyes, tonsils, spinal cord, and dorsal root ganglia of the spine from cattle aged 30 months or older; and the distal ileum (the end of the small intestine) from cattle of all ages. Because complete removal of the dorsal root ganglia is impractical, the Meat Inspection Regulations require removal and disposal of the vertebral column from all cattle aged 30 months or older and it cannot be used in the preparation of mechanically separated meat or finely textured meat. To ensure the complete removal of the distal ileum, the entire small intestine of all cattle, regardless of age, must be removed and disposed of as inedible product. See Health Canada, "Regulations Amending the Food and Drug Regulations," July 2003, http://www.hc-sc.gc.ca/food-aliment/frira-raaii/food_drugs-aliments_drogues/part-partie_11/e_1389.html; and Canadian Food Inspection Agency "Report on Actions Taken by Canada in Response to the

NOTES AND ACKNOWLEDGEMENTS

- Confirmation of a Case of Indigenous BSE, <http://www.inspection.gc.ca/english/animaleheasan/diseas/bseesb/internate.shtml>." In the U.K., specified bovine offal (SBO) was defined differently in 1989. See United Kingdom, *The BSE Inquiry Report*, vol. 6, chap. 3, 77–91; vol. 13, chap. 3, 38–44, <http://www.bseinquiry.gov.uk/index.htm>.
29. Gary Little, "BSE Surveillance in Canada," *CAHNet Bulletin*, Canadian Animal Health Network Edition 8, (Winter 2003): 3; and Alberta Auditor General, *Report of the Auditor General on the Alberta Government's BSE-Related Assistance Programs* (July 27, 2004): 49.
 30. "Farmers Not Meeting BSE Test Quotas," *Letbridge Herald*, August 5, 2004, 1.
 31. Alberta Auditor General, *Report on Alberta Government's BSE-Related Assistance Programs*, 48.
 32. Upton Sinclair, *The Jungle*. (New York: Bantam Books, 1906; Bantam Classics Edition, 1981). For an account of the effect of Sinclair's novel in Canada, see Ian MacLachlan, *Kill and Cbill: Restructuring Canada's Beef Commodity Chain* (Toronto: University of Toronto Press, 2001), 128–31.
 33. U.K. Food Standards Agency, *Report on the Review of Scientific Committees* (2002), <http://www.food.gov.uk/multimedia/pdfs/CommitteesReview.pdf>.
 34. Anne Hardy, "Animals, Disease and Man," *Perspectives in Biology and Medicine* 46 (2003): 200–15.
 35. D. S. Edwards, A. M. Johnston, and G. C. Mead, "Meat Inspection: An Overview of Present Practices and Future Trends," *The Veterinary Journal* 154 (1997): 136.
 36. *Ibid.*, 136, 138.
 37. *Ibid.*, 135–36.
 38. Tag is manure that has caked-up in a thick layer and becomes matted in the hide.
 39. Canadian Cattle Identification Program, <http://www.canadaid.com/>.
 40. Canadian Cattlemen's Association, "Quality Starts Here," <http://www.cattle.ca/QSH/>.
 41. John Spriggs, Jill Hobbs, and Andrew Fearne, "Beef Producers Attitudes to Coordination and Quality Assurance in Canada and the U.K.," *International Journal of Food and Agribusiness Management Review* 3 (2000): 98; and Farm Assured British Beef and Lamb, <http://www.fabbl.co.uk/>.
 42. Eunice Taylor and Joanne Zaida Taylor, "Perceptions of 'the Bureaucratic Nightmare' of HACCP," *British Food Journal* 106 (2004): 65–72.
 43. Reported slaughter for federally and provincially inspected plants does not include unreported domestic slaughter on-the-farm. Agriculture and Agri-Food Canada, *Annual Livestock and Meat Report, 2003*, <http://www.agr.gc.ca/misb/aisd/redmeat/almr2003.htm>.
 44. Saskatchewan, *Final Report of the Live Stock Commission of the Province of Saskatchewan*, (Regina: King's Printer, 1918): 20.
 45. Temple Grandin, *Report on Handling and Stunning Practices in Canadian Meat Packing Plants*, prepared for Agriculture Canada, Canadian Federation of Humane Societies, Canadian Meat Council and Canadian Poultry and Egg Processor's Council, (Fort Collins, CO: Grandin Livestock Handling Systems, 1995).
 46. Gordon Doonan, Martin Appelt, and Alena Corbin, "Nonambulatory Livestock

- Transport: The Need for Consensus,” *Canadian Veterinary Journal* (August 2003), <http://www.inspection.gc.ca/english/anima/heasan/transport/consensuse.shtml>.
47. Canadian Food Inspection Agency, “Interim BSE Export Restriction,” January 2003, <http://www.inspection.gc.ca/english/anima/meavia/commun/20040113come.shtml>.
 48. Grandin, *Report on Handling and Stunning Practices*, 13.
 49. Ontario Office of the Provincial Auditor, 2001 Annual Report, chap. 3.01, <http://www.auditor.on.ca/english/reports/en01/301e01.pdf>.
 50. Deadstock refers to any food animal that has died due to disease or accident sometime prior to processing. In Ontario, it is illegal to sell or process meat from dead animals for human consumption. For details of the various allegations involving Aylmer Meat Packers, see Canadian Food Inspection Agency, “Update — Health Hazard Alert,” September 2003, <http://www.inspection.gc.ca/english/corpaffr/recarapp/2003/20030916e.shtml>, and The Honourable Roland J. Haines, *Farm to Fork: A Strategy for Meat Safety in Ontario*, Report of the Meat Regulatory and Inspection Review (Toronto, 2004): Appendix B.
 51. Haines, *Farm to Fork*, 247–51.
 52. The notable exception is Quebec, which recently established the *Centre québécois d’inspection des aliments et santé animale*, which enjoys a level of independence similar to the CFIA.
 53. Haines, *Farm to Fork*, 245.
 54. Ontario Ministry of Agriculture and Food Inspection Programs, June 2004, <http://www.gov.on.ca/OMAFRA/english/food/inspection/>.
 55. Anthony Giddens, “Risk, Lecture 2,” *BBC Reith Lectures*, 1999, http://www.lse.ac.uk/Giddens/reith_99/week2/week2.htm; Anthony Giddens, *The Third Way and its Critics* (Cambridge: Polity Press, 2000), 135–39; and Michael Jacobs, “Environment, Modernity and the Thirds Way,” in *The Global Third Way Debate*, ed. Anthony Giddens (Cambridge: Polity Press, 2001), 325–26.
 56. United Nations Conference on Environment and Development, “Rio Declaration on Environment and Development,” Principle 15, 1992, <http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm>.
 57. Tony Van der Haegen, “EU View of Precautionary Principle in Food Safety,” European Union in the U.S., October 2003, <http://www.eurunion.org/news/speeches/2003/031023tvdh.htm>.
 58. Canada Privy Council Office, “Framework for the Application of Precaution in Science-Based Decision Making About Risk,” July 2003, http://www.pco-bcp.gc.ca/default.asp?Language=E&Page=publications&Sub=precaution&Doc=precaution_e.htm#1.0.
 59. William Leiss, “BSE Risk in Canada: Finally the Penny Drops,” July 22, 2003, 14–15, <http://www.leiss.ca/chronicles/125>.