HB

367

HEIN
FILE

ALASKA STATE LEGISLATURE

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Special Committee on Economic Development, Trade, & Tourism

Vice Chair
Committee on Labor and Commerce

Vice Chair:
Committee on Transportation

Member:
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REPRESENTATIVE MARK NEUMAN
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"HB 367"

A Summary of the Sale of Raw Milk and Raw Milk Products

According to the FDA and other government officials, raw milk is a public health hazard that puts consumers at risk. You have received documents citing dire health risks from the consumption of raw milk and the FDA has a long powerpoint presentation on its website which argues that raw milk should not be consumed. The enclosed document is a point by point rebuttal of the FDA powerpoint. To summarize:

1. The FDA presents 15 studies purporting to show that raw milk has caused illness and that pasteurization could have protected the public from the illness. Careful analysis reveals that every one of these reports is seriously flawed. In 14 of the studies, there was either no valid positive milk sample or no valid statistical association; in 7 of the studies the findings were misrepresented by the FDA; in 5 of the studies alternative explanations were discovered but not pursued; in 2 of the studies, there was no evidence that anyone consumed raw milk products; and in one study the outbreak did not even exist.

2. All of the outbreaks of listeria attributed to raw milk involved soft cheeses. It is actually impossible to determine whether a cheese is raw using current tests so these cheeses were not necessarily raw as FDA claims. Cases of listeria in raw milk are virtually nil.

3. Not one of the studies presented showed that pasteurization would have prevented the outbreak. The FDA does not present evidence showing that dangerous organisms can survive pasteurization nor that there have been many outbreaks of illness from pasteurized milk.

4. The vast majority of reports on illness caused by raw milk are seriously flawed. But even using these flawed FDA counts of illness, raw milk accounts for only 0.4% of cases of foodborne illness between 1998 and 2005. This is an extremely low number considering that about 5% of all servings of milk consumed are raw milk.

5. Adjusting for bias, pasteurized milk is from 1.1 to 15.3 times more dangerous as raw milk on a per serving basis

6. According to FDA documents (based on exaggerated data on illness from raw milk), deli meats and uncooked hotdogs are 10 times more likely to cause foodborne illness than raw milk. Yet deli meats and hotdogs are freely sold in the state of Alaska.

7. FDA insists that there are no health benefits from raw milk compared to pasteurized, yet the very studies they cite clearly show that raw milk is superior. Enzymatic components in raw milk ensure assimilation of nutrients, kill pathogens and strengthen the immune system. These components are largely inactivated by pasteurization.

8. Pasteurized milk is now one of the eight top allergens; a survey carried out in Michigan indicates that 90% of individuals diagnosed as lactose-intolerant or allergic to milk can drink raw milk without problem.

9. The recent PARSIFAL study in Europe found that the most important factor in protecting children against asthma and allergies was raw milk consumption; the younger the children were when introduced to raw milk, the more protection it conferred. Asthma kills more than 5,000 people in the US yearly; raw milk has killed no one.

10. According to FDA data, out of a total of 437 million servings of raw milk in the US per year, 137 people got some sort of illness. On a per serving basis, that is 3.18 x 10-7. Put another way, you would have to drink 3.18 million glasses of raw milk before you might expect to get an illness of any kind due to that milk. By contrast, 16.5 percent of all broiler chickens tested by the FDA in 2006 contained salmonella bacteria. The rate of human salmonellosis in the US was 14.7 cases per 100,000 people in 2004. This is 4200 cases per year. Yet the citizens of Alaska are free to purchase poultry, but not raw milk.

Alaska State Legislature

Please enter into the record my testimony to the House Finance
Committee name

Committee on Raw Milk - 367, dated 3/26/08
Bill/Subject

My experience milking cows in Alaska goes back to the 50's. At that time there were over 50 dairies in the Matanuska Valley. Today the traditional milk industry is in trouble. One key to getting neighborhood dairies ~~is~~ again by opening a new niche - that of sales of raw milk direct to the public. Please give the farmers a shot at a viable, sustainable enterprise without criminality (which is what they risk today under state law.)

Thanks

Signed: Jerry DeVilliers
Testifier

Viable Farming
Representing (Optional)

2300 N Aurora Lane Palmer 99645
Address

746-6593
Phone number

Please fax to House Finance Committee ASAP. Thank you.

Silveraurora

From: Silveraurora [silvera@mtaonline.net]
Sent: Wednesday, March 26, 2008 2:59 PM
To: 'Silveraurora'
Subject: Finance hearing

I support HB 367

Earlier this committee was talking about the high cost of fuel around the state and helping out those folks who really need the financial assistance.

I'm going to ask you to do the same for all the small milk herd owners around the state. The ability to sell excess raw milk will mean a financial boost to our agricultural economy of the state, which will also have a trickle down effect on all of the businesses in each community as the producers will have more money to spend too.

Raw milk sales are legal in the majority of states in the US and Alaska needs to join that majority.

Small producers want to supply the Alaskan public with a fresh locally grown product that the public goes to THEM to procure - Please consider this - The person with a family cow that wants to sell a few gallons of milk a day to his neighbors; the gal with several goats for her homeschool kids to raise that wants to sell her excess goats milk to the mid-wives she knows; the Grade A dairy that wants to offer fresh milk to those wishing to drive to his farm and fill their jugs and bottles; the family in a remote village that wants to supply their community with access to fresh goats milk from their small herd. The DEC doesn't need to hold everyone's hands and have everyone sign documents and get inspected on a weekly or monthly basis - **the purchasing of raw milk directly from the producer is a private purchase between two parties and the assumption of liability as well as responsibility lies on only those 2 parties!** This bill is not implying mass distribution through retail outlets nor is that desired. A simple safe-handling procedures label applied by the producer to the containers brought by the consumer, i.e., buyer, is all that is needed. This bill does NOT require inspections or licensing, as it should not! This bill is written properly in that all liability is assumed between buyer and seller. The DEC certainly doesn't need more money to create jobs that are not needed, they already have 140 people on staff and that's more than enough to take care of much more important needs of the state.

I have dairy goats and supply breeding stock... I am the first herd in Alaska in decades, if not THE very first herd in Alaska, to go on the federal DHI milk testing program, and have been on it for 4 years. I have my milk tested every month through this program and have even won a national award for lowest somatic cell count for the breed. There are people all over this state with small herds that have been contacted many many times by private individuals who are desperate to purchase raw milk LEGALLY. There are many reasons people want raw milk – fresh, local, and for different uses including religious and cultural needs. We really need to get this bill passed through the Finance Committee today and on to the Senate so that it can get passed into law before this session is over with.

I am more than happy to answer any questions today if anyone has any. Thank you very much for your time!

Suzanne Nevada
Dist 15
Wasilla
907-373-2687
3/26/2008

Alaska State Legislature

Please enter into the record my testimony to the House finance
Committee name

Committee on HB 367, dated 3-26-08
Bill/Subject

Thanks To Rep. Neuman for Sponsoring This Bill
AND Hopefully changing A law That is Long over Due for Change
Please Give The people BACK The Right To Choose where ~~And when~~
They purchase Their milk + Milk products. Whether it Be from The
farm or farmer's market.

There Are Cuerently hundreds of people from Anch, Eagle River,
Wasilla, Palmer Consuming Raw or fresh Milk.

I am one of Them.

Thank You

Signed: Rick Williams
Testifier

FARM
Representing (Optional)

2248 W. Sunset Ave. Wasilla, AK.
Address

AM. 373-2687 Cell 232-8856
Phone number

page 1 19078955017 MAR 26,2008 11:23A

Alaska State Legislature

Please enter into the record my testimony to the Finance committee name.

committee on Raw Milk Bill HB367 bill/subject dated 3/26/07.

Please support this bill! We people deserve to have free choice in what kind of milk we wish to consume. There is plenty of pasturized milk available to those want to make that choice, We who want to choose raw milk deserve the same right. The safety argument is a non issue it is legal in other states, with no problems, It would be against the interest of a seller, to sell bad milk as he would be instantly out of business! It would be a nich market perfect for Alaskan small producers

Signed: _____

Testifier Judson J. Brennan

Representing (Optional) _____

Address PO Box 1165 Delta Jct Ak.

Phone No 895-5753

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Alaska State Legislature

Please enter into the record my testimony to the Finance Committee.
committee name

committee on HB367/Sale of Raw Milk dated 3-26-08.
bill/subject

I support small farms and would like the option of purchasing raw milk from farmers I trust. People who prefer raw milk over pasteurized milk often educate themselves about the risks that accompany the benefits of its consumption. I would like the legal authority to choose the milk I purchase. Thank you for your consideration of our voices.

Signed: Joanna Holbrook
Testifier

Representing (Optional)

P.O. Box 306 Delta Jct. AK 99737
Address

(907) 322-0342
Phone No

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9078955017 P. 05

Alaska State Legislature

Please enter into the record my testimony to the Finance Commitee
committee name

committee on HB367/Sale of Raw Milk, dated 3-26-08
bill/subject

I support small farms and the freedom to buy raw milk.

Signed: Jadon Holbrook
Testifier

Representing (Optional)

Po Box 306 Delta Jct. Ak 99737
Address

(907) 895-1909
Phone No

AK Legislative Information Office

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Alaska State Legislature

Please enter into the record my testimony to the House Committee
committee name

committee on HB367 Sale of Raw Milk dated March 26, 2008
bill/subject

Our family enjoys raw, unhormoned, unpasturized milk and ask you to make it available for the public. Thanks.

Signed: Rachel Holbrook
Testifier

Representing (Optional)

P.O. Box 306 Delta Junction, AK 99737
Address

(907) 895-1909
Phone No.

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Alaska State Legislature

Please enter into the record my testimony to the ~~Senate~~ Finance Committee.
committee name

committee on HB367/Sale of Raw Milk, dated 3-26-08.
bill/subject

I drink raw milk because of health concerns. Please allow me the right to choose, and the ability to continue buying it for personal consumption.

Alaska presently has in place, what amounts to, a state-sanctioned monopoly system, which discourages, and puts out of business the small dairies.

This over-regulation needs to be removed, so the small family farm can, once again, sell dairy products to local markets. I don't need the Dept. of Environmental Conservation's approval on the locally-purchased milk I drink. I have the ability to personally inspect the local milk producers' facility, and make my own decision on whether or not to buy from them. Thanks.

Signed: Jack Holbrook
Testifier

Representing (Optional)

P.O. Box 306, Delta Junction, AK 99737
Address

(907) 895-1909
Phone No

Legislative Information Office

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Alaska State Legislature

Please enter into the record my testimony to the Finance Committee,
committee name

committee on HB367/Sale of Raw Milk dated 3-26-08.
bill/subject

I believe we Alaskans should be able to purchase the milk we prefer, and I prefer raw milk.

Signed: Rebekah Wallrich
Testifier

Representing (Optional)

P.O. Box 306 Delta Jct AK 99737
Address

(907) 895-1909
Phone No

Legislative Information Office

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Alaska State Legislature

Please enter into the record my testimony to the Finance committee committee name.

committee on HB 367/sale of raw milk bill/subject dated 3/26/08.

I believe that small farms and large farms should be able to sell raw milk for human use.

Signed: Jessica Holbrook
Testifier

Representing (Optional)

4250 Mainstreet P.O. Box 306 Delta Jct. Ak
Address

(907) 322-0624
Phone No.

APA Legislative Information Office

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Alaska State Legislature

Please enter into the record my testimony to the Finance Committee,
committee name

committee on HB367/Sale of Raw Milk dated 3/26/08.
bill/subject

I support the sale of raw milk in the state of Alaska.

Signed: Melody Holbrook
Testifier

Representing (Optional)

PO Box 3240 Delta Jct AK 99737
Address

(907) 895-4485
Phone No.

State Legislative Information Office

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Alaska State Legislature

Please enter into the record my testimony to the Finance Committee
committee name
committee on HB 367/Raw Milk dated 3/26/08.
bill/subject

I support this bill that would legalize the sale of raw milk in our state. Consumers need this option, as do farmers.

Signed: Bethel Holbrook
Testifier

Representing (Optional)

HC 60 Box 3240, Delta
Address

895-4485
Phone No

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Alaska State Legislature

Please enter into the record my testimony to the _____ committee name

committee on HB 367 / Raw Milk bill/subject dated 03/26/08

I support the legal sale of raw milk.

Signed _____ Testifier

_____ Representing (Optional)

HC 60 Box 3240 Nolta Jct AK 99737 Address

(907) 895-4485 Phone No

MAR-26-2008 WED 10:21 AM 110 9078955017 P. 01

MAR-26-2008 WED 12:14 PM 110 9078955017 P. 02

Finance committee

HB367 raw milk 3/26/08

I support the legal sale of raw milk

Nathan Barlenook

Hc 60 Box 3240 Delta Jct, AK 99737
(907) 895-4485

HB 367 – Sale of Raw Milk Products

HB 367 allows the sale of raw milk. The Alaska Departments of Environmental Conservation (DEC), Natural Resources (DNR), and Health and Social Services (DHSS) do not support HB 367 and believe mandatory pasteurization for all commercially sold milk and milk products is necessary to protect human health.

Consumption of raw milk poses serious health risks

- Human pathogens commonly found in raw milk include *Campylobacter jejuni*, *E. coli*, *Listeria monocytogenes*, *Salmonella* species, and *Yersinia* species. Introduction of these pathogens into raw milk cannot be eliminated by standard disinfection and sanitation procedures or good animal handling practices alone.
- Numerous federal agencies, including the American Medical Association, the American Public Health Association, the Federal Food and Drug Administration (FDA), and the U.S. Centers for Disease Control and Prevention (CDC) support prohibiting the sale or distribution of raw milk because of the danger it poses to human health.
- CDC has traced more than 1000 illnesses, 104 hospitalizations, and 2 deaths to consumption of raw milk or cheese produced from raw milk from 1998–2005. A list of some of the most recent outbreaks is attached.
- Frequent consumers of milk - children, the elderly, and people with weakened immune systems are at the greatest risk for illness and death from bacteria found in raw milk.

Existing State regulations (18 AAC 32) prohibit the sale of raw milk

- The State of Alaska dairy and public health experts agree that raw milk should not be sold commercially. This prohibition was codified over 10 years ago.

Pasteurization has not been shown to substantially alter the nutritional value

- The pasteurization process uses heat to destroy harmful bacteria without significantly changing milk's nutritional value. In addition to killing disease-causing bacteria, pasteurization destroys bacteria that cause spoilage, extending the shelf life of milk.
- Pasteurization does not result in an appreciable loss of protein
- Pasteurization does not result in an appreciable loss of fat-soluble vitamins (A, D, E andK)
- Pasteurization results in a loss of B-complex vitamins on the order of 0-10%
- Pasteurization results in a loss of vitamin C on the order of 0-10%
- According to FDA, raw milk does not contain compounds that will kill harmful bacteria, making the product safe.
- Pasteurized milk does not cause lactose intolerance or allergic reactions any more than raw milk.

Outbreaks happen in states with regulatory programs that allow sale of raw milk

- Between 1973 and 1992, raw milk was associated with 46 outbreaks; 87% of these outbreaks occurred in states where commercial distribution of raw milk was legal.
- In 2001, Wisconsin banned cow-leasing programs after 75 people became infected with *Campylobacter jejuni* bacteria from drinking unpasteurized milk obtained through such a program.

Selected recent outbreaks of human illness associated with raw milk consumption

- **July 2007**—Public health officials in Pennsylvania stopped Stump Acres Dairy raw milk sales due to an outbreak of *Salmonella* infection. The first outbreak occurred earlier in 2007; however, raw milk was put back on sale after the dairy farm passed the state's regulatory testing. Raw milk sales were again prohibited several weeks later after a second outbreak of *Salmonella* infection was identified. The dairy was allowed to re-open its raw milk market until a third outbreak of Salmonella occurred in July. Even with testing and the utmost care by the producer the raw milk product could not be kept safe for public consumption.
- **December 2005**—Public health officials in Clark County, Washington were notified of four county residents with laboratory confirmed *Escherichia coli* O157:H7 infection. All four residents reported having consumed raw milk obtained from a Cowlitz county farm.
- **July 2004**—The Indiana Public Health Department advised consumers to check their refrigerators and freezers for raw milk cheese that may be contaminated with *Salmonella*. Routine product sampling found *Salmonella* in "Natural Raw Milk Cheese" made by Meadow Valley Farm after the cheese was distributed to farmers' markets and specialty food stores in parts of Indiana and Wisconsin.
- **2002–2003**—Two children were hospitalized in Ohio for infection with *Salmonella* Typhimurium. These children and 60 other people in Illinois, Indiana, Ohio, and Tennessee developed bloody diarrhea, cramps, fever, chills, and vomiting from *S.* Typhimurium that was tracked to consuming raw milk.
- **2000–2001**—In North Carolina, 12 adults were infected with *Listeria monocytogenes* linked to homemade, Mexican-style fresh soft cheese produced from contaminated raw milk sold by a local dairy farm. Ten of the 12 victims were pregnant women, and infection with the bacterium resulted in five stillbirths, three premature deliveries, and two infected newborns.

Current Regulation of Raw Milk – Alaska

Code of Federal Regulations - 21 CFR 1240.61 "No person shall cause to be delivered into interstate commerce or shall sell, otherwise distribute, or hold for sale or other distribution after shipment in interstate commerce any milk or milk product in final package form for direct human consumption unless the product has been pasteurized or is made from dairy ingredients (milk or milk products) that have all been pasteurized....."

"The final rule does not apply to the interstate transportation of raw (unpasteurized) milk to dairy processing plants for pasteurization or to raw milk products in intrastate commerce". 52 Fed. Reg. 29509 (1987) at 29509

[DEC interpretation – raw milk cannot be sold across State lines but States have the choice of adopting legislation allowing it to be sold intrastate

State Statute: 17.20.005 "...The commissioner may issue orders, regulations, permits, quarantines, and embargoes relating to (4) .... Grading of milk and milk products and standards of sanitation for dairies offering to the public or selling milk or milk products to at least the minimum of current recommendations of the United States Public Health Service pasteurized milk ordinance as it may be periodically be revised."

[DEC interpretation – At a minimum, DEC is to comply with the U.S. Pasteurized milk ordinance (PMO) and apply it to all milk products sold or offered in the State. Raw milk would not meet the PMO standards and thus this subsection effectively prohibits the sale of raw milk in Alaska.]

State Regulations 18 AAC 32:
The State of Alaska has adopted the federal regulations outright so the exact same rules apply as directed by the Statute. You can access the current pasteurized milk ordinance at http://www.cfsan.fda.gov/~ear/pmo03toc.html

18 AAC 32.060
...A milk producer may not allow raw milk or a raw milk product, including cream from raw milk, to be removed from the dairy farm unless

(1) the product is being transported directly to a milk processing plant with a permit issued under 18 AAC 32.030 or by another state; or
(2) the product has been decharacterized with an approved denaturant and labeled "FOR ANIMAL FOOD NOT FOR HUMAN CONSUMPTION" in letters at least three inches high on each container; for the purposes of this paragraph, "approved denaturant" means
    a. finely powdered charcoal;
    b. FD & C Blue No. 1, FD & C Blue No. 2, Ultramarine Blue; or
    c. FD & C Green No.3, FD & C Red No. 3, or FD & C Red No. 40

[DEC prohibits the removal of raw milk from a dairy farm unless the raw milk is being transported for processing or the milk is intended for animal food and has been denatured through the addition of food coloring.]

DHSS Raw Milk Talking Points

DHSS Position

- The Alaska Department of Health and Social Services takes the firm position that the health risks associated with legalizing the sale of raw milk substantially outweigh the benefits because
  - unpasteurized milk is far more likely to contain human pathogens than pasteurized milk and thereby increases the risk of serious, sometimes fatal, infectious illness among milk consumers, and
  - those who are at increased risk for serious health outcomes include the developing fetus, young children, and the elderly who may be incapable of making an informed decision, and
  - the potential health benefits of raw milk consumption are largely unsubstantiated by empirical scientific evidence.

Statistics

- Many human pathogens are commonly found in raw milk, including *E. coli O157:H7* and *Salmonella*
  - *Also Listeria monocytogenes, Campylobacter jejuni, Mycobacterium* and *Yersinia* species
- These pathogens may be shed directly from the animal (cow, goat, etc) or contaminate the product during the collection and handling process.
- Multiple studies have illustrated a dramatic increase in the incidence of multi-drug resistant bacteria present on farms (livestock operation, dairy farms, vegetable and fruit farms), which results in increased health risks among infected persons.
- In 1995, raw milk accounted for approximately 1% of all milk sales in states that permit the sale of raw milk (Headrick)
- Raw milk contamination
  - A study performed by the USDA Agricultural Research Service and published in the Journal of Dairy Science in 2004 collected raw milk samples from 861 farms in 21 states. They found *Salmonella in* 2.6% and *Listeria monocytogenes* in 6.5% of samples.
  - Another study was conducted in 2002 at Penn State. In this study samples were collected from 248 dairy herds from 16 counties in Pennsylvania. *Campylobacter jejuni*, Shiga toxin-producing *Escherichia coli, Listeria monocytogenes, Salmonella*, and *Yersina enterocolitica*, were present in anywhere from 2 to 6 % of the samples.
  - A third study sampled milk from 131 dairies in Minnesota and South Dakota. *Campylobacter jejuni*, Shiga toxin-producing *Escherichia coli, Listeria monocytogenes, Salmonella*, and *Yersina enterocolitica*, were present in anywhere from 4 to 9 % of the samples.
  - A fourth study was reported in 2005 in the Journal Emerging Infectious Diseases. Raw milk samples were collected over 3 years from 316 farms in the USA, from the Northeast, Midwest and West. The raw milk was tested for the presence of Coxiella burnetii, which causes Q-Fever in people. (The symptoms of Q Fever range from malaise, muscle soreness, fever, hepatitis, endocarditis.) Domestic livestock (cows, sheep, and goats) are the primary reservoirs for Coxiella burnetii. In this study over 94 % of the samples tested positive for Coxiella. This disease is endemic not only in the US but other studies have shown it to be a world wide problem.
- Between 1973 and 1992, raw milk was associated with 46 outbreaks; 87% of these outbreaks occurred in states where commercial distribution of raw milk was legal (American Journal of Public Health 1998;88:1219-1221).
  - 6 outbreaks were reported during 476 state-years for sates in which the intrastate sale of raw milk was not legal (1.26 outbreaks per 100 state-years), compared with 40 outbreaks during 544 state-years for states in which the intrastate sale of raw milk was legal (7.35 outbreaks per 100 state-years).
  - The number of reported outbreaks per 10 million person-years in states that permitted the intrastate sale of raw milk was 0.14, compared with 0.03 outbreaks per 10 million person-years in states where the intrastate sale of raw milk was illegal.
- Between 1998 and 2005, CDC traced more than 1000 illnesses, 104 hospitalizations, and 2 deaths to consumption of raw milk or cheese produced from raw milk.
- In 2001, Wisconsin banned cow-leasing programs after 75 people became infected with *Campylobacter jejuni* bacteria from drinking unpasteurized milk obtained through such a program

- CDC's FoodNet Survey was performed in 9 US states in 2002. It showed that of >8,000 people surveyed, 81.6% reported consuming any milk in the past 7 days, and 3.5% reported consuming raw milk
- New data from CDC show that between 1998-2006, 92% (46 of 50) of outbreaks linked to liquid milk consumption for which the pasteurization status of the milk was known were due to the consumption of unpasteurized milk (unpublished data)

Pasteurization

- High Temperature/Short Time (HTST) pasteurization heats the milk to at least 161° for at least 15 seconds
- The milk is immediately cooled to below 40° and packaged into plastic jugs or plastic-coated carton
- Pasteurization must be sufficient to destroy all human pathogens that may be carried in the milk from the cow
- Pasteurization temperatures are sufficient to destroy all yeasts, mold, and many of the spoilage bacteria
- Microbiological standards for milk as recommended by the U.S. Public Health Service:
    - Grade A raw milk for pasteurization should not to exceed 300,000 bacteria per ml
    - Grade A pasteurized milk should not exceed 20,000 bacteria per ml

Need to Focus on Comparing Raw vs. Pasteurized Milk

- Most foods run the risk of being contaminated with human pathogens; the risk varies depending on the origin of the food product, how it is raised, and how it is handled by the producer, distributer, and consumer
- One of the primary duties of government involves protecting the public's health by making the food supply safer
- Each food group is assessed independently
- This bill is not about the legality of selling raw beef, chicken, oysters, or honey—it is about the legality of selling raw milk
- Therefore, we need to focus on comparing the risks and benefits associated with a new law that would legalize the sale of raw milk in Alaska, and use regulations to protect the public's health
- The risk of serious and potentially lethal infectious illness associated with raw milk products are substantially greater than the risks associated with pasteurized milk products
- Pasteurized milk can become contaminated after pasteurization during handling or packaging (just as any processed food) and result in outbreaks; however, raw milk sold to the consumer starts out with higher bacterial loads and is far more likely to be contaminated with human pathogens than pasteurized milk
- The developing fetus, young children, the elderly, and immune-compromised persons are at highest risk for severe health outcomes resulting from infections commonly associated with contaminated milk consumption

Duty to Protect

- Duty to protect the food supply
- Duty to protect those who do not have the capacity or sufficient information needed to make a well informed decision
    - The developing fetus, young children, the elderly
    - This bill would allow the sale of raw milk to restaurants, but provides no mandate to inform restaurant customers that they might be served raw milk or to ensure products are not distributed incorrectly

Potential Raw Milk Costs

- DEC costs for testing, monitoring, and inspections
- DHSS costs for outbreak investigations
- Costs to state government associated with outbreak investigations are substantial (time, money, resources)
- Direct and indirect costs involved resulting from the persons who become ill (and their family members)
    - A study of E. coli O157:H7 infections in the US showed that the average cost per case ranged from <$100 for an individual who does not obtain medical care to *$6.2 million* for a patient who died from hemolytic uremic syndrome (JFP 2005)
- Loss of public trust in product and in government officials
- Cost to industry if an outbreak occurs

Benefits of Raw Milk Consumption

- Possible financial benefit to struggling small dairy farmers and consumers
- Taste
- Minimal scientific evidence of possible health benefits
    - Possible beneficial impact on allergy, asthma, and digestive health
    - Negligible evidence of nutritional benefits--pasteurization may inactivate a small percentage of B vitamins, particularly thiamine, and up to 20 % of the vitamin C in milk but milk is not a major source of either one of these nutrients

The Pleural of Anecdote is not Data

- Need to use available scientific data to drive health policy decisions
- Just because someone grew up on a farm and does not remember getting sick from drinking raw milk, does not equate to proof that passing a law to legalize the sale of raw milk is okay. That's like saying that because someone has driven their entire life without ever wearing a seatbelt and has not been injured in a car accident that seatbelt laws are unfounded.

Summary

The Alaska Department of Health and Social Services strongly opposes this bill on grounds that allowing the sale of raw milk poses a substantial risk to the health of Alaskans.

Office of the State Veterinarian Robert F Gerlach VMD

Mr. Chairman and members of the House Resource Committee; thank you for allowing me to submit written testimony regarding HB 367. If you have any questions after reading this document I would be happy to answer any questions.

The Raw Milk issue is one that is filled with strong scientific opposition from one side and equally staunch enthusiastic support on the other side. Public health officials present overwhelming evidence illustrating the disease risk associated with the product and a large number of agencies and organizations support this fact. Arguments defending raw milk compare risk to other food products and the apparent small number of food borne outbreaks currently related to raw milk. Statistics are used to try to justify each side and unfortunately statistics can often confuse the issue if used improperly.

Important points to remember regarding the recommendations of doctors (MDs or veterinarians) is that we take an oath upon graduation to "at first, do no harm" and we are trained to take preventative measures to protect our patients or clients from illness. All public health officials are held to this standard; prevent the outbreak of disease and do not wait till the disease occurs to take action. Public health officials recommend that raw milk be pasteurized prior to consumption to reduce the risk of disease to the public, especially the members of the public who are at greater risk: the immuno-compromised, the very young, and the elderly. The scientific studies performed by researchers and the data presented by public health officials and agencies (FDA) is peer reviewed and validated prior to publication in the literature, it is not anecdotal. When these studies are criticized, carefully consider the arguments and check the source of the data so the conclusions are not misrepresented.

When evaluating the arguments presented for both sides, comparisons must be made on an equal basis, apples to apples; raw milk products versus pasteurized milk products. Not raw milk versus processed or raw meats, vegetables or fruits. The other consideration is to look at the data in the contexts of the study, use the same background population to evaluate the results. According to current statistics less than 2% of the US population drinks raw milk, so the over all number of reported food borne outbreaks associated with raw milk will appear to be less when compared to other foods. The milk produced from any mammal (cow, goat, yak, or even moose was referenced) has significant risk of being contaminated with all types of bacteria including human pathogens. In addition to the milk being contaminated when it is collected and handled, animals may shed pathogens directly into the milk intermittently without showing any sign of illness. So there is no way to predict when the milk may contain disease causing pathogens and even with testing no way to guarantee the product is safe.

As a veterinarian and a public health official I cannot support the sale and distribution of raw milk products to the general public.

I have included the following information for your review.

A. The Economic Impact on Agriculture

This bill was introduced as a mechanism to stimulate the development of agriculture in Alaska. I feel the implications of this bill will have significant effect on the present dairy industry. The sale of raw milk is not only a public health concern, but it can also impact the economic viability of the entire agricultural industry with obvious emphasis on the vulnerable dairy industry in Alaska. The disease outbreaks associated with raw milk sales *negatively impacts the public trust* of agricultural products. Dr Jayarao, MVSc, PhD, MPH **(Professor of Veterinary Public Health and Extension Veterinarian, the Pennsylvania State University, Association Council on Public Health and Regulatory Veterinary Medicine)** has found that in the aftermath of a food borne disease outbreak from a raw milk product, sales of all dairy products will be impacted not just the raw milk products. This has great implications to the owners and the workers at the 6 dairy farms and

the two dairy processing plants in the state. In addition there are other farmers (hay producers) and support businesses that also are economically tied to these farms. Dairy farming is their livelihood and the financial security of their families. It is unfair to put these producers and workers that have so much at stake at greater risk of economic jeopardy without a through discussion with all parties involved.

There are recent 4 studies that illustrate the inherent risk of disease associated with raw milk.
These scientific surveys tested raw milk and detected food borne pathogens in the bulk tank samples collected at the farm.

A) A study performed by the USDA Agricultural Research Service and published in the Journal of Dairy Science in 2004 collected raw milk samples from **861 farms** in **21 states**. They found *Salmonella in* 2.6% and *Listeria monocytogenes* in 6.5% of raw milk samples.

B) The second study was conducted in 2002 at Penn State. In this study samples were collected from **248 dairy herds** from 16 counties in Pennsylvania. *Campylobacter jejuni*, Shiga toxin-producing *Escherichia coli*, *Listeria monocytogenes*, *Salmonella*, and *Yersina enterocolitica*, were present in anywhere from **2 to 6 %** of the raw bulk tank milk samples.
Of major importance was that the *Salmonella* Newport (a well known human pathogen) that was isolated from 5 farms was resistant to more than 5 antibiotics.

C) The third study sampled milk from **131 dairies** in Minnesota and South Dakota. *Campylobacter jejuni*, Shiga toxin-producing *Escherichia coli*, *Listeria monocytogenes*, *Salmonella*, and *Yersina enterocolitica*, were present in anywhere from **4 to 9 %** of the raw bulk tank milk samples.

Although the prevalence appears to be low, these pathogens pose a significant risk to consumers of raw milk and raw milk products.

D) The last study was reported in 2005 in the Journal Emerging Infectious Diseases. Raw milk samples were collected over 3 years from **316 farms** in the USA, from the Northeast, Midwest and West. The raw milk was tested for the presence of Coxiella burnetii, which causes Q-Fever in people. (The symptoms of Q Fever range from malaise, muscle soreness, fever, hepatitis, endocarditis.) Domestic livestock (cows, sheep, and goats) are the primary reservoirs for Coxiella burnetii. In this study over **94 %** of the samples tested positive for Coxiella. This disease is endemic not only in the US but other studies have shown it to be a world wide problem.

These farms were using standard hygiene practices during milking (hand washing, cleaning the cow's udder prior to milking, sanitizing and disinfecting the equipment, and keeping the milking area separate from the rest of the farm) and were able to reduce but **not eliminate the risk for milk contamination.**

Example of a Recent Documented Incident

- **July 2007**—Public Health Officials in PA stopped Stump Acres Dairy raw milk sales due to an outbreak of Salmonella. The problems with the raw milk products at this certified dairy began earlier in 2007. After the first outbreak (February 2007) the raw milk was put back on sale once the state finished its investigation and the milk once again passed the state's regulatory testing. Raw milk sales were again prohibited several weeks later after a second outbreak of Salmonella was identified. The dairy was allowed to re-open its raw milk market until a third outbreak of

Salmonella occurred in July. Even with testing and the utmost care by the producer the raw milk product could not be kept safe for public consumption.

Disease Outbreaks caused by Consumption of Raw Milk

An epidemiological study on food borne diseases associated with raw milk in the United States was published in the American Journal of Public Health in 1998. They reported that **between 1973 and 1992, raw milk was associated with 46 outbreaks of food borne illness in the United States, and it is significant to note that the authors found 40 of 46 (87%) of these outbreaks occurred in states where the intrastate sale of raw milk was legal at the time.**

Published scientific data regarding the disease risk associated with raw milk products has resulted in the following agencies to support prohibiting the sale or distribution of raw milk:

National Farm Bureau
National Association of States Departments of Agriculture
National Environmental Health Association
National Association of Food and Drug Officials
American Public Health Association
Federal Food and Drug Administration
Centers for Disease Control
American Medical Association
American Veterinary Medical Association
American Academy of Pediatricians
International Association of Food Protection
Health Canada

Note that not all these listings are public health agencies, several are groups concerned with the economic development of agriculture and food production. This is not an exhaustive list.

B. The Public Health Risk

Dr McLaughlin covered this subject very well during his testimony and presented the information regarding several recent outbreaks. I will only make a few comments.

In recent years, this issue of sale of raw milk has become more relevant than ever before due to the emergence of **antimicrobial resistant in food borne pathogens** such as *Salmonella, Staphylococcus (MRSA), Campylobacter* and *Escherichia coli.* An infection with a drug resistant strain can result in a severe illness and death due to the lack of an effective antibiotic treatment. These bacteria have developed this resistance due to a number of reasons and they are present in all areas of the environment: hospitals, schools, farms, in wildlife and our homes. These organisms are more prevalent in environments where animals (both wild and domestic) are located. Recently multidrug resistant strains of bacteria were isolated in normal healthy wild birds in the Arctic.

Secondary Complications associated with Food Borne Disease

Gastroenteritis is the primary condition associated with cases of food borne illness attributable to raw milk consumption.

- Enteritis caused by *E. coli* and *Salmonella* spp. is usually self-limiting for the average person. The very young, elderly, and immunocompromised individuals are at a higher risk of serious illness and life threatening consequences.
- *Campylobacter jejuni* and *Y. enterocolitica* illnesses are typically characterized by gastritis and enterocolitis.
- **A new disease syndrome** has been identified in humans following an episode of food borne illness with these pathogens found in raw milk. The result is a debilitating post infection immunologic condition that can include Guillian-Barré syndrome and reactive arthritis.
- Unlike other food borne bacteria, which mainly cause gastritis and enteritis, *L. monocytogenes* causes listeriosis, which is characterized by septicemia and meningitis in humans.

C. The benefits of raw milk have not been substantiated

Consumption of raw bulk tank milk is a common practice among farm families. Studies have reported that the most prevalent consumers of raw milk are dairy farm families and dairy farm employees. The primary reason for consumption is convenience and taste. Proponents of raw milk might believe that these products not only taste better but provide better nutrition than pasteurized products and decrease the risk for different medical conditions; but these benefits have never been proven or validated scientifically. There is recent evidence that shows an association between the consumption of raw milk and the decrease in allergic related asthma cases. The authors of this study support the need for further research but stress that they cannot recommend the consumption of raw milk products due to the risk of food borne disease pathogens.

Pasteurization may inactivate a small percentage of B vitamins, particularly thiamine, and up to 10 % of the vitamin C in milk but milk is not a major source of either one of these nutrients. Pasteurization does not sterilize milk, some bacteria can be found in store bought products that is why it must be refrigerated and is manufactured with a sell by date listed. **Pasteurization does eliminate food borne pathogens.**

The health benefits of raw dairy products are unsubstantiated. However the risks associated with food borne pathogens are well-documented. The perception of health benefits should not outweigh the considerable risk to the general public of consuming raw milk.

Summary of the Facts

- Raw milk can be a significant source of food borne pathogens.
- Consumption of raw milk by an immunocomprised, young or elderly population puts them at higher risk of infection and life threatening consequences.
- With the emergence of new diseases and antibiotic resistant bacteria in raw milk and other foods, it is **essential that milk sold to the public must be pasteurized**, and milk products be made from pasteurized milk.
- **Public health safety should be the number one priority** over other issues related to sale of raw milk and milk products in Alaska.

- A food borne disease outbreak associated with raw milk will negatively impact the public trust in Alaska Grown Products and directly impact the Alaska dairy producers and related support industry. Development of this industry should not occur without researching the impacts on current agricultural industry in the state.
- Scientific evidence does not exist to support the fact that the raw milk has more health benefits as compared to pasteurized milk.
- **The intent is not to eliminate or restrict a private individual's choice; the intent is to prevent the sale and distribution of a potentially dangerous product.** Consumption of raw milk remains a preventable cause of food borne disease outbreaks in Alaska.

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Pasteurization

Introduction

The process of pasteurization was named after **Louis Pasteur** who discovered that spoilage organisms could be inactivated in wine by applying heat at temperatures below its boiling point. The process was later applied to milk and remains the most important operation in the processing of milk.

Definition:

The heating of every particle of milk or milk product to a specific temperature for a specified period of time without allowing recontamination of that milk or milk product during the heat treatment process.

Purpose There are two distinct purposes for the process of milk pasteurization:

1. **Public Health Aspect** - to make milk and milk products safe for human consumption by destroying all bacteria that may be harmful to health (pathogens)

2. **Keeping Quality Aspect** - to improve the keeping quality of milk and milk products. Pasteurization can destroy some undesirable enzymes and many spoilage bacteria. Shelf life can be 7, 10, 14 or up to 16 days.

The extent of microorganism inactivation depends on the combination of temperature and holding time. Minimum temperature and time requirements fo milk pasteurization are based on thermal death time studies for the most heat resistant pathogen found in milk, *Coxelliae burnetii*. Thermal lethality determinations require the applications of microbiology to appropriate processing determinations. An overview can be found here.

To ensure destruction of all pathogenic microorganisms, time and temperature combinations of the pasteurization process are highly regulated:

Ontario Pasteurization Regulations

Milk:
63° C for not less than 30 min.,
72° C for not less than 16 sec.,
or equivalent destruction of pathogens and the enzyme phosphatase as permitted by Ontario Provincial Government authorities. Milk is deemed pasteurized if it tests negative for alkaline phosphatase.

Frozen dairy dessert mix (ice cream or ice milk, egg nog):
at least 69° C for not less than 30 min;
at least 80° C for not less than 25 sec;
other time temperature combinations must be approved (e.g. 83° C/16 sec).

Milk based products- with 10% mf or higher, or added sugar (cream, chocolate milk, etc)
66° C/30 min, 75° C/16 sec

There has also been some progress with low temperature pasteurization methods using membrane processing technology..

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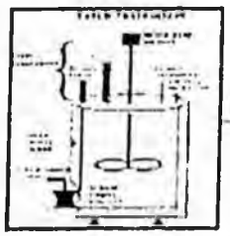
Methods of Pasteurization

There are two basic methods, batch or continuous.

Batch method

The batch method uses a vat pasteurizer which consists of a jacketed vat surrounded by either circulating water, steam or heating coils of water or steam.



Batch Pasteurizer (26 KB)

In the vat the milk is heated and held throughout the holding period while being agitated. The milk may be cooled in the vat or removed hot after the holding time is completed for every particle. As a modification, the milk may be partially heated in tubular or plate heater before entering the vat. This method has very little use for milk but some use for milk by-products (e.g. creams, chocolate) and special batches. The vat is used extensivly in the ice cream industry for mix quality reasons other than microbial reasons.

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Continuous Method

Continuous process method has several advantages over the vat method, the most important being time and energy saving. For most continuous processing, a high temperature short time (HTST) pasteurizer is used. The heat treatment is accomplished using a **plate heat exchanger.** This piece of equipment consists of a stack of corrugated stainless steel plates clamped together in a frame. There are several flow patterns that can be used. Gaskets are used to define the boundaries of the channels and to prevent leakage. The heating medium can be vacuum steam or hot water.

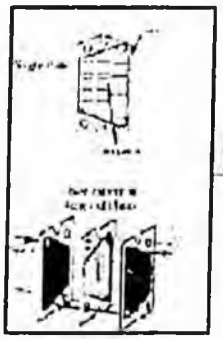


Plate Heat Exchanger 26 KB

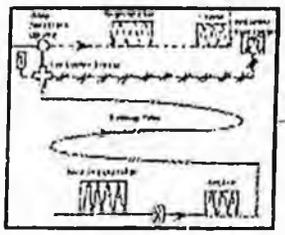
HTST Milk Flow Overview

This overview is meant as an introduction and a summary. Each piece of HTST equipment will be discussed in further detail later.

Cold raw milk at 4° C in a constant level tank is drawn into the **regenerator** section of pasteurizer. Here it is warmed to approximately 57° C - 68° C by heat given up by hot pasteurized milk flowing in a counter current direction on the opposite side of thin, stainless steel plates. The raw milk, still under suction, passes through a positive displacement **timing pump** which delivers it under positive pressure through the rest of the HTST system.

The raw milk is forced through the heater section where hot water on opposite sides of the plates heat milk to a temperature of at least 72° C. The milk, at pasteurization temperature and under pressure, flows through the **holding tube** where it is held for at least 16 sec. The maximum velocity is governed by the speed of the timing pump, diameter and length of the holding tube, and surface friction. After passing temperature sensors of an **indicating thermometer** and a **recorder-controller** at the end of the holding tube, milk passes into the **flow diversion device (FDD).** The FDD assumes a forward-flow position if the milk passes the recorder-controller at the preset cut-in temperature (>72° C). The FDD remains in normal position which is in diverted-flow if milk has not achieved preset cut-in temperature. The improperly heated milk flows through the diverted flow line of the FDD back to the raw milk **constant level tank.** Properly heated milk flows through the forward flow part of the FDD to the pasteurized milk regenerator section where it gives up heat to the raw product and in turn is cooled to approximately 32° C - 9° C.

The warm milk passes through the cooling section where it is cooled to 4° C or below by coolant on the opposite sides of the thin, stainless steel plates. The cold, pasteurized milk passes through a **vacuum breaker** at least 12 inches above the highest raw milk in the HTST system then on to a storage tank filler for packaging.



Basic Flow - HTST Pasteurization 17 KB

Holding Time

When fluids move through a pipe, either of two distinct types of flow can be observed. The first is known as **turbulent flow** which occurs at high velocity and in which eddies are present moving in all directions and at all angles to the normal line of flow. The second type is streamline, or **laminar flow** which occurs at low velocities and shows no eddy currents. The ***Reynolds number***, is used to predict whether laminar or turbulent flow will exist in a pipe:
Re < 2100 laminar
Re > 4000 fully developed turbulent flow

There is an impact of these flow patterns on holding time calculations and the assessment of proper holding tube lengths.

The holding time is determined by timing the interval for an added trace substance (salt) to pass through the holder. The time interval of the fastest particle of milk is desired. Thus the results found with water are converted to the milk flow time by formulation since a pump may not deliver the same amount of milk as it does water.

Note: the formulation assumes flow patterns are the same for milk and water. If they are not, how would this affect the efficiency of the pasteurization process?

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Pressure Differential

For contiunuous pasteurizing, it is important to maintain a higher pressure on the pasteurized side of the heat exchanger. By keeping the pasteurized milk at least 1 psi higher than raw milk in regenerator, it prevents contamination of pasteurized milk with raw milk in event that a pin-hole leak develops in thin stainless steel plates. This **pressure differential** is maintained using a timing pump in simple systems, and differential pressure controllers and back pressure flow regulators at the chilled pasteurization outlet in more complex systems. The position of the timing pump is crucial so that there is suction on the raw regenerator side and pushes milk under pressure through pasteurized regenerator. There are several other factors involved in maintaining the pressure differential:

- The balance tank overflow level must be less than the level of lowest milk passage in the regenerator
- Properly installed booster pump is all that is permitted between balance tank and raw regenerator
- No pump after pasteurized milk outlet to vacuum breaker
- There must be greater than a 12 inch vertical rise to the vacuum breaker
- The raw regenerator drains freely to balance tank at shut-down

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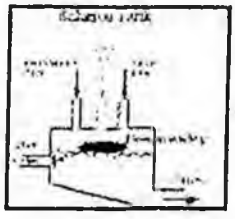
Basic Component Equipment of HTST Pasteurizer

Balance Tank

The balance, or constant level tank provides a constant supply of milk. It is equipped with a **float valve assembly** which controls the liquid level nearly constant ensuring uniform head pressure on the product leaving the tank. The overflow level must always be below the level of lowest milk passage in regenerator. It, therefore, helps to maintain a higher pressure on the pasteurized side of the heat exchanger. The balance tank also prevents air from entering the pasteurizer by placing the top of the outlet pipe lower than the lowest point in the tank and creating downward slopes of at least 2%. The balance tank provides a means for recirculation of diverted or pasteurized milk.



Balance Tank 17 KB

Regenerator

Heating and cooling energy can be saved by using a regenerator which utilizes the heat content of the pasteurized milk to warm the incoming cold milk. Its efficiency may be calculated as follows:

% regeneration = temp. increase due to regenerator/total temp. increase

For example: Cold milk entering system at 4° C, after regeneration at 65° C, and final temperature of 72° C would have an 89.7% regeneration:

$$\frac{65 - 4}{72 - 4} = 89.7$$

Timing pump

The timing pump draws product through the raw regenerator and pushes milk under pressure through pasteurized regenerator. It governs the rate of flow through the holding tube. It must be a **positive displacement** pump equipped with variable speed drive that can be legally sealed at the maximum rate to give minimum holding time in holding tubes. It also must be interwired so it only operates when FDD is fully forward or fully diverted, and must be "fail-safe". *A centrifigal pump with magnetic flow meter and controller may also be used (see below).*

Holding tube

Must slope upwards 1/4"/ft. in direction of flow to eliminate air entrapment so nothing flows faster at air pocket restrictions.

Indicating thermometer

The indicating thermometer is considered the most accurate temperature measurement. It is the official temperature to which the **safety thermal limit recorder** (STLR) is adjusted. The probe should sit as close as possible to STLR probe and be located not greater than 18 inches upstream of the flow diversion device.

Recorder-controller (STLR)

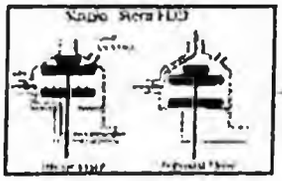
The STLR records the temperature of the milk and the time of day. It monitors, controls and records the position of the flow diversion device (FDD) and supplies power to the FDD during forward flow. There are both **pneumatic** and **electronic** types of controllers. The operator is responsible for recording the date, shift, equipment, ID, product and amount, indicating thermometer temperature, cleansing cycles, cut in and cut out temperatures, any connects for unusual circumstances, and his/her signature.

Flow Diversion Device (FDD)

Also called the flow diversion valve (FDV), it is located at the downstream end of the upward sloping holding tube. It is essentially a 3-way valve, which, at temperatures greater than 72° C,opens to **forward flow**. This step requires power. At temperatures less than 72° C, the valve recloses to the normal position and diverts the milk back to the balance tank. It is important to note that the FDD operates on the measured temperature, not time, at the end of the holding period. There are two types of FDD:

single stem - an older valve system that has the disadvantage that it can't be cleaned in place.

dual stem - consists of 2 valves in series for additional fail safe systems. This FDD can be cleaned in place and is more suited for automation.



Flow Diversion Devices 17 KB

Vacuum Breaker

At the pasteurized product discharge is a vacuum breaker which breaks to atmospheric pressure. It must be located greater than 12 inches above the highest point of raw product in system. It ensures that nothing downstream is creating suction on the pasteurized side.

Auxiliary Equipment

Booster Pump

It is centrifugal "stuff ng" pump which supplies raw milk to the raw regenerator for the balance tank. It must be used in conjunction with pressure differential controlling device and shall operate only when timing pump is operating, proper pressures are achieved in regenerator, and system is in forward flow.

Homogenizer

The homogenizer may be used as timing pump. It is a positive pressure pump; if not, then it cannot supplement flow. Free circulation from outlet to inlet is required and the speed of the homogenizer must be greater than the rate of flow of the timing pump.

Magnetic flow meter and centrifugal pump arrangements

Magnetic flow meters can be used to measure the flow rate. It is essentially a short piece of tubing (approximately 25 cm long) surrounded by a housing, inside of which are located coils that generate a magnetic field. When milk passes through the magnetic field, it causes a voltage to be induced, and the generated signal is directly proportional to velcoity. Application of the magnetic flow meter in the dairy industry has centered around its replacing the positive displacement timing pump as the metering device in HTST pasteurizing systems, where with certain products the timing pump rotors reportedly wear out in a relatvely short period of time. In operation, the electrical signal is sent by the magnetic flow meter to the flow controller, which determines what the actual flow is compared to the flow rate set by the operator. Since the magnetic flow meter continuously senses flow rate, it will signal the electronic controller if the actual flow exceeds the set flow rate for any reason. If the flow rate is exceeded for any reason, the flow diversion device is put into diverted flow. A significant difference from the normal HTST system (with timing pump) comes into focus at this point. This system can be operated at a flow rate greater than (residence time less than) the legal limit. However, it will be in diverted flow and never in forward flow.

Another magnetic flow meter based system with an AC variable frequency motor control drive on a centrifugal pump is also possible in lieu of a positive displacement metering pump on a HTST pasteurizer.This system does not use a control valve but rather the signal from the magnetic flow meter is transmitted to the AC variable frequency control to vary the speed of the centrifugal pump. The pump, then controls the flow rate of product through the system and its holding time in the holding tube.

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Automated Public Health Controllers These systems are used for time and temperature control of HTST systems. There are concerns that with sequential control, the critical control points (CCP's) are not monitored all the time; if during the sequence it got held up, the CCP's would not be monitored. With operator control, changes can be made to the program which might affect CCP's; the system is not easily sealed. No computer program can be written completely error free in large systems; as complexity increases, so too do errors.

This gives rise to a need for specific regulations or computer controlled CCP's of public health significance:

1. dedicated computer - no other assignments, monitor all CCP's at least once/sec
2. not under control of any other computer system or override system, i.e., network
3. separate computer on each pasteurizer
4. I/O bus for outputs only, to other computers no inputs from other computers
5. on loss of power - public health computers should revert to fail safe position (e.g. divert)
6. last state switches during power up must be fail safe position
7. programs in ROM - tapes/disks not acceptable
8. inputs must be sealed, modem must be sealed, program sealed
9. no operator override switches

10. proper calibration procedure during that printing - Public health computer must not leave public health control for > 1 sec and upon return must complete 1 full cycle before returning to printing
11. FDV position must be monitored and temperature in holding tube recorded during change in FDV position
12. download from ROM to RAM upon startup
13. integrated with CIP computer which can be programmed e.g., FDV, booster pump controllable by CIP computer when in CIP made only

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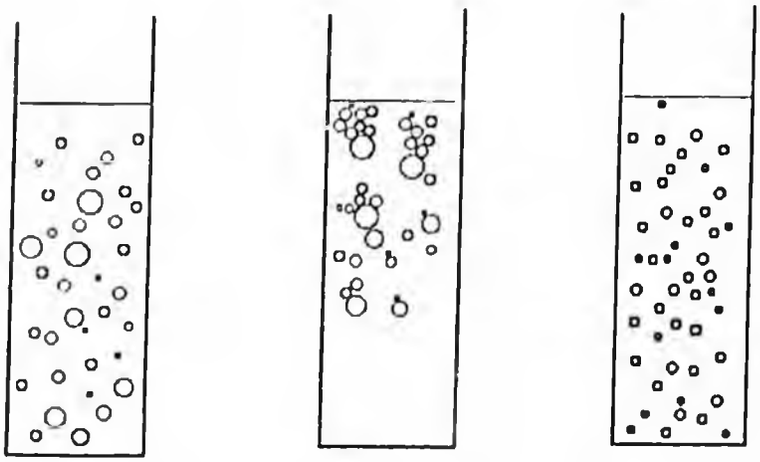
Back to the Home Page of Dairy Science and Technology, University of Guelph

Homogenization of Milk and Milk Products

The following topics will be covered in this section:

Introduction

Milk is an oil-in-water ***emulsion***, with the fat globules dispersed in a continuous skimmilk phase. If raw milk were left to stand, however, the fat would rise and form a cream layer. Homogenization is a mechanical treatment of the fat globules in milk brought about by passing milk under high pressure through a tiny orifice, which results in a decrease in the average diameter and an increase in number and surface area, of the fat globules. The net result, from a practical view, is a much reduced tendency for creaming of fat globules. Three factors contribute to this enhanced stability of homogenized milk: a decrease in the mean diameter of the fat globules (a factor in Stokes Law), a decrease in the size distribution of the fat globules (causing the speed of rise to be similar for the majority of globules such that they don't tend to cluster during creaming), and an increase in density of the globules (bringing them closer to the continuous phase) owing to the adsorption of a protein membrane. In addition, heat pasteurization breaks down the cryo-globulin complex, which tends to cluster fat globules causing them to rise.



Raw milk

Cold, raw milk after 1 hour

Homogenized milk during storage

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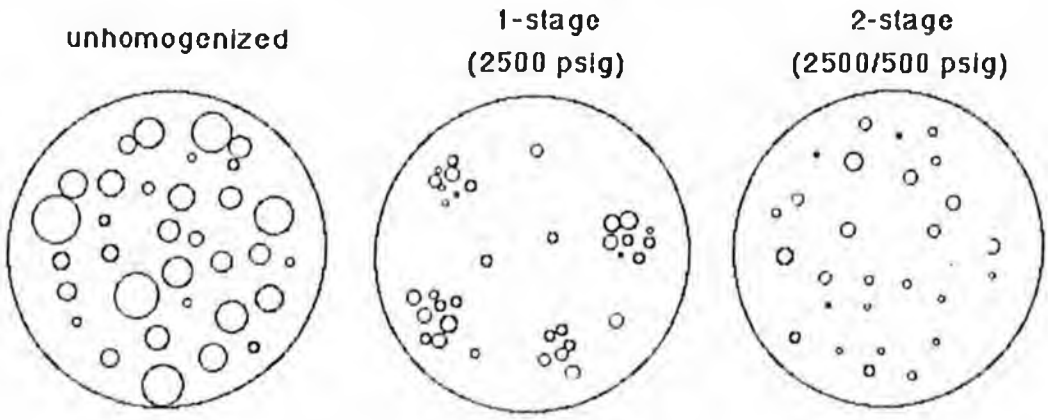
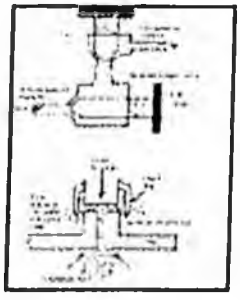
Homogenization Mechanism

Auguste Gaulin's patent in 1899 consisted of a 3 piston pump in which product was forced through one or more hair like tubes under pressure. It was discovered that the size of fat globules produced were 500 to 600 times smaller than tubes. There have been over 100 patents since, all designed to produce smaller average particle size with expenditure of as little energy as possible. The homogenizer consists of a 3 cylinder positive piston pump (operates similar to car engine) and homogenizing valve. The pump is turned by electric motor through connecting rods and crankshaft.

To understand the mechanism, consider a conventional homogenizing valve processing an emulsion such as milk at a flow rate of 20,000 l/hr. at 14 MPa (2100 psig). As it first enters the valve, liquid velocity is about 4 to 6 m/s. It then moves into the gap between the valve and the valve seat and its velocity is increased to 120 meter/sec in about 0.2 millisec. The liquid then moves across the face of the valve seat (the land) and exits in about 50 microsec. The homogenization phenomena is completed before the fluid leaves the area between the valve and the seat, and therefore emulsification is initiated and completed in less than 50 microsec. The whole process occurs between 2 pieces of steel in a steel valve assembly. The product may then pass through a second stage valve similar to the first stage. While most of the fat globule reduction takes place in the first stage, there is a tendency for clumping or clustering of the reduced fat globules. The second stage valve permits the separation of those clusters into individual fat globules.

The Effects of 2-stage Homogenization on Fat Globule Size Distribution as Seen Under the Light Microscope





Homogenizer and Valve 17 KB

UNIVERSITY of GUELPH

It is most likely that a combination of two theories, turbulence and cavitation, explains the reduction in size of the fat globules during the homogenization process.

Turbulence

Energy, dissipating in the liquid going through the homogenizer valve, generates intense turbulent eddies of the same size as the average globule diameter. Globules are thus torn apart by these eddie currents reducing their average size.

Cavitation

Considerable pressure drop with charge of velocity of fluid. Liquid cavitates because its vapor pressure is attained. Cavitation generates further eddies that would produce disruption of the fat globules.

The high velocity gives liquid a high kinetic energy which is disrupted in a very short period of time. Increased pressure increases velocity. Dissipation of this energy leads to a high energy density (energy

per volume and time) Resulting diameter is a function of energy density.

In summary, the homogenization variables are:

- type of valve
- pressure
- single or two-stage
- fat content
- surfactant type and content
- viscosity
- temperature

Also to be considered are the droplet diameter (the smaller, the more difficult to disrupt), and the log diameter which decreases linearly with log P and levels off at high pressures.

Effect of Homogenization:

Fat globule

	No Homogenization	15 MPa (2500 psig)
Av. diam. (μ m)	3.3	0.4
Max. diam. (μ m)	10	2
Surf. area (m^2/ml of milk)	0.08	0.75
Number of globules (μ m^{-3})	0.02	12

Surface layer

The milk fat globule has a native membrane, picked up at the time of secretion, made of amphiphilic molecules with both hydrophilic and hydrophobic sections. This membrane lowers the interfacial tension resulting in a more stable emulsion. During homogenization, there is a tremendous increase in surface area and the native milk fat globule membrane (MFGM) is lost. However, there are many amphiphilic molecules present from the milk plasma that readily adsorb: casein micelles (partly spread) and whey proteins. The interfacial tension of raw milk is 1-2 mN/m, immediately after homogenization it is unstable at 15 mN/m, and shortly becomes stable (3-4 mN/m) as a result of the adsorption of protein. The transport of proteins is not by diffusion but mainly by convection. Rapid coverage is achieved in less than 10 sec but is subject to some rearrangement.

Surface excess is a measure of how much protein is adsorbed; for example 10 mg/m^2 translates to a thickness of adsorbed layer of approximately 15 nm.

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Kountry Life How-To

Pasteurizing Milk

If you don't have a store-bought pasteurizer, you can easily perform this task on your stovetop.

You can use the double-boiler method. If you don't have a standard double-boiler, just use two pots, one large and one smaller, so that the small one can fit into the large one. The reason you want to do this is so that the milk doesn't scald on the bottom.

Directions;

Put a few inches of water in the bottom half of the double-boiler. In the top pan, place your milk. Using a thermometer, heat the milk up to 161 degrees F slowly. Stir it to make sure the milk is an even temperature throughout.

After it is brought up to 161 degrees F, remove the top pan and set it in sink full of very cold water to cool it quickly.

KP, from WA, entered 1999-12-19

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University of Guelph

From Wikipedia, the free encyclopedia

University of Guelph

Motto:	*Rerum cognoscere causas* (To understand the causes of things)
Established	1964
Type:	Public
Endowment:	$164.2 Million[1]
Chancellor:	Pamela Wallin
President:	Alastair Summerlee
Staff:	830
Undergraduates:	17,332[2]
Postgraduates:	2,076 [3]
Location:	Guelph, ON, Canada
Campus:	Urban/Suburban—4.1 km² (1,017 acres (4 km²))
Sports:	Gryphons
Colours:	Red and Yellow/Gold
Mascot:	Gryph
Athletics:	www.gryphons.ca
Website:	www.uoguelph.ca

The **University of Guelph** is a medium-sized university located in Guelph, Ontario, established in 1964. While the U of G offers degrees in many different disciplines, the university is best known for its focus on life sciences, based in part on a long-standing history of achievement in Agriculture and Veterinary Medicine and within Canada for its School of Fine Art and Music.

The University of Guelph is currently ranked by *Maclean's* magazine as the top comprehensive university in Canada ("comprehensive" indicating institutions with significant research activity and a range of programs at the undergraduate and graduate levels, including professional degrees). It has also held this ranking in 1999, 2002, and 2003, with its reputation, innovative research-intensive programs, and lively campus life cited as particular strengths.

The university is also home to the Ontario Veterinary College, Ontario's only veterinary school.

The university's School of English and Theatre Studies is a leader in Canadian literary and dramatic writing and theory, employing many leading voices in its field.

The university is represented in Canadian Interuniversity Sport by the Guelph Gryphons.

Contents

History

The Ontario Agricultural College (OAC) began in 1874 as an associate agricultural college of the University of Toronto. Its first building was Moreton Lodge, located where Johnston Hall now stands, which included classrooms, residences, a library, and a dining room. (Several buildings constructed during this time period are still a part of campus life today, including President's Residence, Raithby House, and Day Hall.)

The Macdonald Institute was established in 1903 to house women's home economics programs at the college. The growth spurt from 1900 to 1906 also saw the construction of MacDonald Hall, Massey Hall and the Bullring.

Several important buildings were opened in 1922, including the Ontario Veterinary College main building, Mills Hall (formerly a men's residence, converted to co-ed in 2000), and Food Science. Johnston Hall was constructed in 1931, taking the place of the torn-down Moreton Lodge. Johnston would house the OAC Administration from that year forth.

In 1964, the Ontario Agricultural College, the Macdonald Institute, and the Ontario Veterinary College amalgamated and were granted University status, giving life to the University of Guelph as it is now known.

Shortly after, during the period of 1967 to 1975, massive construction took place, giving rise to many new and expansive buildings such as the McLaughlin Library, the MacKinnon Building, the University Centre and South Residence.

New construction has been taking place since 2001 as a result of the anticipated rise in enrolment due to the Ontario double cohort and population increases. New buildings already constructed include the Gryphon Dome, the East Village Residences, Rozanski Hall and the New Science Complex. Guelph now enjoys a global reputation as "the Warwick [University] of Canada".

Campus

The main university campus spans 1,017 acres (4.1 km²), including the 408 acre (1.7 km²) University of Guelph Arboretum and a 30 acre (0.1 km²) research park.

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Dairy Foods Science Notes

Version 07-01-07

BASIC DAIRY BACTERIOLOGY

DEFINITION

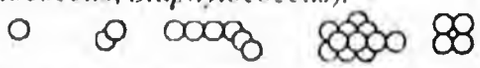
Bacteria are single celled organisms that can only be seen with the aid of a microscope ("microorganisms"). All processes needed for life occur within a single cell. Bacteria are considered *procaryotes*. Their basic cell structure differs from cells of plants and animals (*eucaryotes*); for example they lack a true nucleus and have a unique cell wall. Bacteria can be found wherever life exists; some are considered useful, such as those responsible for nutrient conversion (e.g., decomposition) and food fermentation (e.g., cheese), while others are considered harmful, such as those responsible for food spoilage and disease. Individual bacteria are named by *Genus* and *species* (e.g., *Bacillus cereus*), as are all living organisms. They are classified according to their appearance and general structure and by specific characteristics of their metabolism and growth, including nutrient requirements, growth temperatures, oxygen requirements, by their ability to use specific substrates (e.g., certain sugars), and by specific by-products of their metabolism. Currently, genetic profiling techniques have become standard tools in the identification/classification of bacteria, often beyond species level (e.g., sub-species, allelic types). There are literally thousands of species of bacteria, though only select groups are of concern to the dairy industry. The following will describe the general characteristics important for characterizing bacteria that are common in milk and dairy products. Although not specifically covered, comments pertaining to dairy fungi (yeast & molds) are included.

GENERAL CHARACTERISTICS

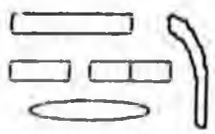
Appearance - Size and Shape:

To actually see bacteria, a microscope is required, generally one with a magnification of 1000X. Bacteria are measured in microns (1 micron = 1/1000 mm = 1/25,000 inch). When a standard light microscope is used, bacterial cells are normally stained to make them easier to see. Bacteria can be observed in milk by staining a dried milk smear on a microscope slide with a specific "milk-stain" (e.g., Levowitz-Weber Stain). Bacteria grown in a petri-dish (e.g., on a semi-solid nutrient "agar" media) or in a nutrient broth, can be smeared and dried on a slide and stained with a simple stain (e.g., methylene blue) or complex stain (see *gram-stain*, next page) for observation. Bacteria exist in a variety of shapes, sizes and arrangements, which are defining characteristics for most types. Typical shapes, sizes & arrangements of bacteria that might be seen in milk and dairy products are:

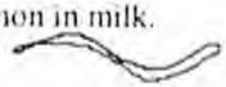
Cocci ------ Spherical cells, 0.4 - 1.5 microns. Occur as single cells, pairs, chains or clusters. (e.g., Genera - *Streptococcus*, *Staphylococcus*).



Bacilli ------ Rod shaped, 0.5 - 30 microns. Occur as single cells, pairs or chains (e.g., Genera - *Lactobacillus*, *Bacillus*, *Pseudomonas*).



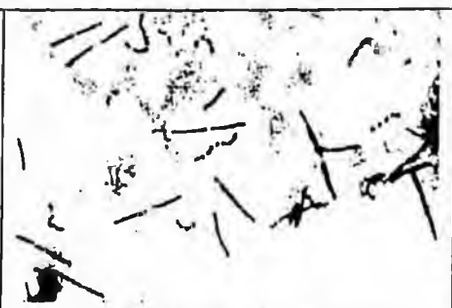
Spirilla -- Spiral or helical shaped rods of varied size. Generally are not very common in milk. (e.g., Genus - *Campylobacter*).



Provided with support from the NY State Dairy Promotion Order; dairy farmers dedicated to the production, manufacture & distribution of quality dairy products

Milk smears under the microscope stained with Levowitz-Weber Stain:

a. Cocci in "tetrad" clusters. 1000 × magnification.



b. A smear of yogurt culture; long rods and cocci in chains.

c. Cocci in pairs ("diplococci") and a few short chains

Gram-Stain Reaction:

Most bacteria are classified as either "**gram-positive**" or "**gram-negative.**" This is typically determined by the **gram-stain procedure**, which is used to view and differentiate bacteria under the microscope; it is one of the first steps used when classifying bacteria. The gram-stain is a four step procedure with Crystal Violet (blue) and Safranin (red) as the primary stains. Depending on the characteristics of the bacteria (e.g., cell wall structure), they will stain either blue (gram-positive) or red (gram-negative). In some cases an organism classified as "gram-positive" may stain red or appear grainy with blue and red shades. These organisms may be referred to as "gram-variable":

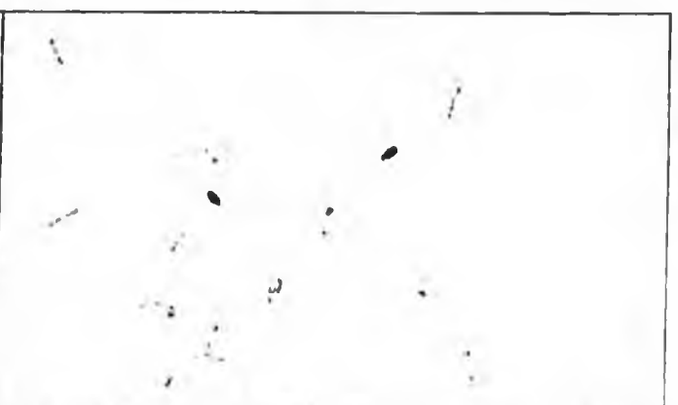
Gram-positive (blue) ... e.g., *Bacillus* (rod), *Streptococcus* (cocci), *Staphylococcus* (cocci)

Gram-negative (red) .... e.g., *Pseudomonas* (rods), *E. coli* & other coliform bacteria (rods)

Gram-variable ..... Stain blue or red depending on conditions; most are truly Gram-pos.

There are a few generalizations based on the gram-stain reaction that can be made of microorganisms common to dairy products. For example, gram-negative bacteria do not survive pasteurization; bacteria that do survive are gram-positive (but not all gram-positive survive); certain gram-negative bacteria, if present, will spoil milk faster under refrigeration compared to gram-positive spoilage organisms; certain antibiotics are more effective against gram-positive than gram negative bacteria.

Large gram-positive (blue) rods and cocci in chains & clusters and gram-negative rods (red).



Spore-stain of a *Bacillus* species; vegetative cells stain red while spores stain green or appear clear.

Endospore (Spore) Formation:

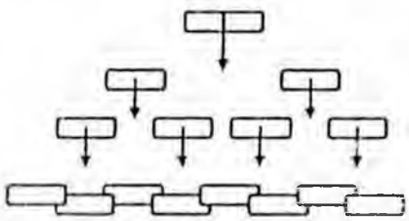
Endospores, or "spores," are protective, dormant structures that allow an organism to survive under adverse conditions. When conditions become unfavorable (e.g., lack of nutrients), vegetative growth ("multiplication") stops and "spores" begin to form within the cell. During sporulation a thick coating develops and encases the cell's genetic material. Spores forming inside a cell may be seen as swollen,

possibly clear, areas or may not be apparent at all. Special spore stains facilitate seeing spores under the microscope (see page 2). Bacterial spores released from the cell have increased resistance to heat, drying, nutrient deprivation, chemicals, sanitizers, and other conditions that would normally kill the vegetative, actively growing cell. Spores can remain dormant for extended periods of time (e.g., for years). When conditions become favorable, a spore can "germinate" and return to an actively growing state. Spores may be "activated" into growth by heat or some other "trigger." Spores are produced by only few select groups of bacteria. Bacteria in the genera *Bacillus*, *Paenebacillus*, *Geobacillus* and *Clostridium* are common gram-positive, spore-forming rods, which have some importance to dairy. Some strains stain gram-variable. Spores are commonly found in soil and other environmental sources.

BACTERIAL REPRODUCTION (GROWTH)

Bacteria reproduce by a process known as **Binary Fission**; one cell divides into two cells, each of which divides into two more cells and so on. Bacterial **Growth** is defined as an increase in cell numbers or cell mass. **Growth Rate** is the change in cell numbers per unit time. The time it takes for a bacterial population to double or go through one reproductive cycle is called the **Generation Time**. Generation times vary with each organism and are dependent on nutrient availability and environmental conditions (e.g., temperature). Under optimum conditions for growth, generation times may be as short as 10 to 20 minutes for some bacteria. When conditions are less favorable for growth, such as when temperatures are low, generation times will be longer (growth rate is slower), sometimes dramatically (e.g., it may take days for one cell division).

If One Bacterial Cell Reproduced Every Hour in 24 Hours There Would Be ~17,000,000 Cells

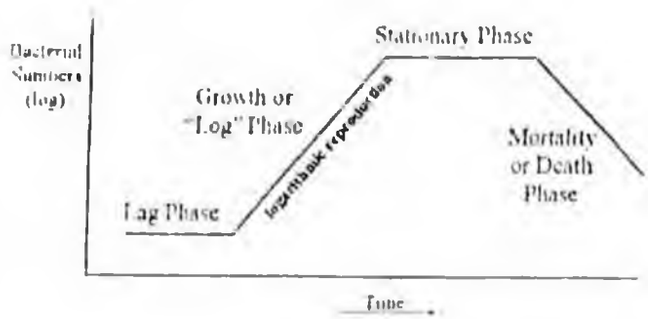


and so on .....

Hour	Count	Hour	Count
0	1	9	512
1	2	10	1,024
2	4	11	2,048
3	8	12	4,096
4	16	:	:
5	32	18	262,144
6	64	:	:
7	128	:	:
8	256	24	~17,000,000

During cell division, bacteria may not totally separate from each other. Some bacteria divide in one specific direction. With cocci (spherical bacteria), this type of cell division can result in pairs (diplococci) or chains (streptococci) that are characterizing features of certain bacteria. Other bacteria divide in several directions, resulting in tetrads or clumps. Rods generally divide in one direction resulting in pairs or chains connected end to end. Examples of cell arrangements are on page 1 & 2.

Bacterial Growth Curve: When bacteria are presented into a new growth environment, they often first go through a **lag phase** or adjustment period where no growth is apparent. This is followed by the active **exponential** or **logarithmic growth phase**. As the environment changes (e.g., nutrients deplete, inhibitors develop), growth will level off to a **Stationary Phase**, after which cells will then begin to die off (**Death Phase**).



REQUIREMENTS AND CONDITIONS FOR GROWTH

Bacterial species vary widely as to what conditions are conducive for growth. Conditions that are optimum for one organism may be lethal for another. Nutrient availability, moisture, pH, the presence or absence of oxygen, the presence of inhibitors and temperature can all influence the growth of bacteria. In most cases these are not independent variables but are interactive.

Nutrient Requirements:

Bacteria are versatile in their ability to use certain nutrients, although different organisms vary in their specific requirements. Some bacteria have very specific needs that make them difficult to culture. Generally, all bacteria require the following, in one form or another:

Energy Source – from carbohydrates, proteins, lipids.

Carbon Source – from carbohydrates, proteins, lipids, carbon dioxide

Nitrogen Source – from proteins, peptides, amino acids, ammonia, nitrates.

Vitamins – primarily water soluble B-vitamins.

Minerals, Metal Ions & Salts – such as potassium, phosphorus, calcium, magnesium, iron

Milk provides sufficient nutrients needed to support the growth of a host of microorganisms. Bacteria are capable of utilizing the proteins, fats, carbohydrates and vitamins in milk for their growth and metabolism. Different bacterial species may differ in regard to the **enzymes** they have or need to break down milk components. Enzymes are biological catalysts, usually protein in nature, that facilitate a biochemical reaction, either breaking down or building a biological compound (e.g., "protease" enzymes break down proteins; "lipase" enzymes break down fats). Microbial growth and enzyme activity results in an increase of microbial numbers that eventually leads to measurable changes in milk components and characteristics and the development of by-products that directly effect the product either in a beneficial (e.g., cheese fermentation) or harmful (e.g., milk spoilage) manner.

pH of Growth Medium or Food:

pH is a measure of acidity and alkalinity, expressed on a scale of 0-14, which is the negative logarithm of hydrogen ion activity of the solution or food.

0 ..... 7 14
Acidic — Neutral — Alkaline

Most bacteria grow best at a neutral (pH 7) or slightly higher pH, although this varies with the different organisms. Most bacteria will not grow below pH 4.0 or above pH 10. The pH of normal milk is around 6.7, which allows the growth of many types of bacteria. Cultured products have lower pHs.

Dairy Starter Cultures or Lactic Acid Bacteria (LAB) produce lactic acid and are capable of growth at lower pH values than other bacteria (pH 4.0 – 5.0). Culturing milk prevents many spoilage or harmful bacteria from growing. LAB may produce sufficient acid to eventually limit their own growth if allowed to do so. Yeast and mold are capable of growth over a wider pH range, including very low pH values, which is why these microorganisms are common causes of spoilage of cultured milk products.

Moisture or Available Water:

All bacteria require relatively high levels of available moisture, which can be expressed as **water activity, (A_w)**. Pure water has an A_w of 1.00, while fluid milk is extremely close to this value. Sugars and salts react with water in a manner that binds the water and lowers the level of available water (lower A_w). Drying processes lower the available water by removing it. Most bacteria require an A_w of greater than 0.91 and generally will not spoil foods that are lacking available water. Fluid milk is a perishable food that easily spoils, while milk powder can be stored unrefrigerated for long

periods of time. Yeast and molds generally require less water for growth than bacteria, which is why foods such as jams and jellies are only spoiled by these types of microorganisms.

Oxygen Requirements:

Some bacteria require oxygen while other bacteria will not grow in its presence. In fact, oxygen may actually be toxic to certain bacteria. Bacteria are classified based on their requirement for the presence or absence of oxygen as follows:

Aerobic - requires the presence of oxygen for growth.

Anaerobic - requires the absence of oxygen for growth (oxygen may be lethal).

Facultative Anaerobic - can grow with or without oxygen.

Milk contains dissolved oxygen, thus it supports the growth of aerobic and facultatively anaerobic microorganisms. Rarely do strict anaerobes grow in milk. Cheese may have a reduced oxygen environment due to the growth of culture bacteria. An oxygen-free environment may occur in the center of some cheeses allowing the growth of certain anaerobic bacteria, some of which cause serious defects (e.g., late gas-blowing). *Clostridium botulinum* is an anaerobe that produces a deadly toxin that has rarely been associated with dairy foods. Some bacteria such as certain starter cultures are considered "microaerophilic," meaning they grow best in lower levels of oxygen.

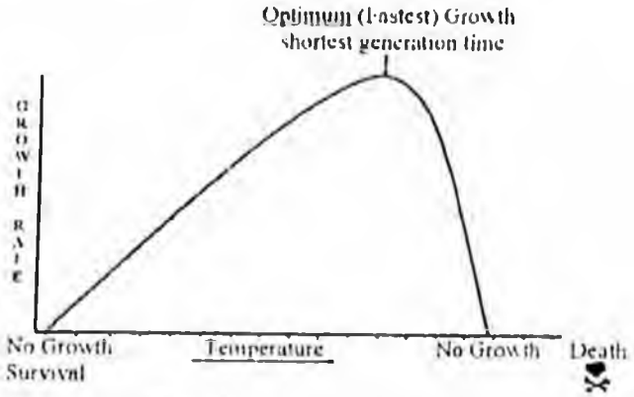
The Presence of Inhibitors:

There are a number of chemical substances that can inhibit the growth of (*bacteriostatic*) or kill (*bactericidal*) bacteria. Some examples relevant to dairy microbiology are drugs or antibiotics, lactoferrin (natural in raw milk), carbon dioxide, lysozyme (an enzyme), sanitizers, organic acids, preservatives (e.g., potassium sorbate) and natural inhibitors formed by microorganisms (e.g., nisin).

Temperatures for Growth:

The optimum temperature for growth for a bacterium is the temperature where its generation time is shortest or it grows the fastest. Each bacterium has a minimum and maximum temperature for growth, which will vary between species and strains and with other environmental conditions. Outside of this range, growth does not occur. Bacteria are often grouped based on their optimum, minimum and maximum temperatures for growth. These are not rigid ranges as some bacterial species may overlap into adjacent groups. General groupings of bacteria and approximate ranges are as follows:

Thermophilic ...	Min:	104°F (40°C)
"Heat Loving"	Max:	140°F (>60°C)
	Opt:	122-131°F (50-55°C)
Mesophilic	Min:	41°F (5°C)
Medium Temps	Max:	122°F (50°C)
	Opt:	86-98°F (30-37°C)
Psychrophilic ...	Min:	32°F (0°C) or less,
"Cold Loving"	Max:	77°F (25°C)
	Opt:	<69°F <20°C)



Psychrotrophs:

The types of bacteria that are of most significance to the dairy industry are those that can grow under refrigeration conditions. *"Cold Tolerant" organisms capable of growth at temperatures at or below 7°C (44.6°F), regardless of their optimum temperatures* are generally referred to as **Psychrotrophs** or **Psychrotolerant** (the term currently used by microbiologists to describe this group). "Mesophilic" bacteria (medium optimum temp.) that grow under refrigeration would be considered *psychrotrophs*.

Regardless of the range of temperatures for growth, temperatures colder than the optimum for an organism will generally increase the generation time or slow its growth. When temperatures approach the freezing point of water (32°F/0°C), growth of most microorganisms is prevented, although a few organisms will continue to grow very, very slowly at or even below freezing. Most microorganisms will survive freezing (without growth), depending on the medium that they are frozen in. When temperatures exceed the maximum growth temperature for an organism, growth stops. When temperatures are increased further, they eventually become lethal. Heat is often used to inactivate or kill microorganisms (e.g., as in pasteurization); generally, higher temperatures result in greater kill.

Temperature versus Generation Time
(example of one organism studied)

Temperature	Generation Time
37°C (100°F)	20 Minutes
32°C (90°F)	25 Minutes
27°C (80°F)	40 Minutes
21°C (70°F)	60 Minutes
16°C (60°F)	150 Minutes
10°C (50°F)	12 Hours
4.4°C (40°F)	>24 Hours

BACTERIA OF CONCERN IN FLUID MILK

Pathogenic/Foodborne Illness Bacteria:

Pasteurization was originally designed to destroy pathogenic bacteria that caused tuberculosis, brucellosis, typhoid and Q-fever, illnesses that were often associated with the consumption of raw milk. Milk pasteurization, coupled with improved animal husbandry procedures, has virtually eliminated most of these types of illnesses. Raw milk may also harbor other organisms associated with foodborne illness, including *Salmonella*, *Listeria*, *Campylobacter*, *Yersinia* and certain strains of *E. coli*. These organisms are also killed by pasteurization. However, cross-contamination of processed dairy products with raw milk and/or the direct consumption of raw milk have resulted in relatively recent outbreaks of foodborne illnesses involving these organisms. Pasteurized milk products can also be contaminated from poor processing and handling conditions and poor worker hygiene.

Pathogens of Historical Significance (currently rare)	
Coxiella burnetti.....	Q-fever, flu-like
Mycobacterium spp.	Tuberculosis
Brucella abortus	Brucellosis, abortions
Salmonella typhi	Typhoid fever
Streptococcus spp.	Septic sore throat
vnebacterium diphtheriae .	Diphtheria

For more information on Foodborne Pathogens:
http://www.cfsan.fda.gov/~mow/intro.html

Pathogens Associated with more Recent Outbreaks	
Salmonella spp.	GI* illness, secondary**
Campylobacter jejuni	GI illness, secondary
Yersinia enterocolitica ...	GI, pseudo-appendicitis
E. coli (O157:H7)	GI (hemorrhagic), HUS (kidney failure)
Listeria monocytogenes ..	GI* illness, meningitis, sepsis, stillbirths

* GI = gastro-intestinal illness; symptoms may include nausea, vomiting, diarrhea, cramps & sometimes fever & chills.
** Secondary = non-GI symptoms may follow, e.g., arthritic rxn

Mastitis Causing Bacteria:

Bacteria that can cause *mastitis*, an infection of the mammary gland of dairy cattle, include contagious (e.g., *Staphylococcus aureus*, *Streptococcus agalactiae*) and environmental (e.g., coliforms) organisms. Mastitis can result in increased somatic cell counts (white blood cells) and in some cases, increased bacteria counts in the bulk milk, both of which result in decreased milk quality. For more information on mastitis visit the National Mastitis Council (http://www.nmconline.org).

Psychrotrophic (Psychrotolerant) Bacteria:

Psychrotrophic or psychrotolerant bacteria are capable of growing at 7°C (44.6°F) or less. Psychrotrophs are of primary concern to the dairy industry since they grow and cause spoilage in raw or processed dairy products commonly held under refrigeration.

a) The most commonly occurring psychrotrophs in milk are gram-negative rods, many belonging to the genus *Pseudomonas*. Gram-negative psychrotrophs generally do not survive pasteurization, thus they occur in processed milk as post-pasteurization contaminants (PPC).

b) Psychrotrophs are common in the dairy environment. Milk soils (e.g., on dirty equipment) can support the growth of psychrotrophs and other contaminants that can contaminate subsequent milk. Marginal cooling can result in relatively large numbers of these organisms in milk. Psychrotrophs may also be present in low numbers in untreated water supplies used for rinsing dairy equipment.

c) Psychrotrophic bacteria produce a variety of enzymes that cause chemical deterioration of milk resulting in off-flavors. Some of these enzymes are not inactivated by pasteurization or by other heat treatments and may continue to degrade milk products, even when the bacterium is destroyed. This has been shown to be a concern with shelf-stable (Ultra-High Temperature) milk, but there is limited information relative to conventionally pasteurized milks.

Thermoduric Bacteria:

Thermoduric bacteria are a miscellaneous group of bacteria that are capable of surviving pasteurization or other heat treatments. As a general rule, all thermoduric bacteria are gram-positive. Spore-forming bacteria (e.g., *Bacillus, Paenibacillus*) comprise some of the most heat resistant bacteria.

a) Chief sources of thermodurics in milk are poorly cleaned equipment including old rubber parts, areas of milkstone build-up, separators and other difficult to clean or neglected areas (soil build-up). They may contaminate milk at the farm or at the plant. Poor pre-milking hygiene procedures (e.g., dirty cows) may also influence thermoduric levels in raw milk, especially with spore-formers.

b) High thermoduric counts in raw milk may result in counts that exceed legal limits in the pasteurized milk made from that raw milk (> 20,000 cfu/milliliter).

c) Most thermodurics are not psychrotrophic, but some are. In the absence of gram-negative psychrotrophs, certain thermoduric bacteria may grow and cause spoilage of pasteurized milk. Heat Resistant Spore-Forming Psychrotrophs belonging to *Bacillus* & *Paenibacillus* are considered common thermoduric psychrotrophs that have become limiting factors in milk shelf-life.

Coliform Bacteria:

Coliform bacteria are defined as "aerobic or facultatively anaerobic, gram-negative rods, that ferment lactose with the production of acid and gas." These characteristics allow selective counting of these types of bacteria in milk and dairy products. They are considered "**indicator organisms**" because they are easy to detect and their presence in food & water indicate some form of contamination; e.g., the presence of "fecal" coliforms (*E. coli*) suggests the possibility of fecal contamination.

a) They are called *Coliforms* because some members of the group are found in the intestines (colon) of warm-blooded animals (fecal coliforms). However, some coliform bacteria are common as environmental contaminants and/or are associated with other habitats (e.g., plant matter).

b) Coliforms are almost always found in raw milk although with good production methods the numbers can be kept very low. Sources of coliform contamination can be dirty cows and manure, dirty equipment and, in some cases, cows with coliform mastitis.

c) Coliforms do not survive pasteurization. When detected in processed milk or dairy products, they *indicate* recontamination after pasteurization (Post-Pasteurization Contamination).

SELECT ORGANISMS COMMON TO MILK & DAIRY PRODUCTS:

Grouping/Organisms	General Characteristics and Importance to Milk or Milk Products
Gram-Positive Cocci:	
Enterococcus spp.	Short chains or pairs of cells. "Fecal" streptococci (but are not coliform); common in fecal matter, but also in the dairy farm environment. Used as indicator organisms in some foods. Acid producers. Some strains have some heat resistance.
Lactococcus lactis	Short chains or pairs. "Lactic" streptococci; produce lactic acid. Some strains are used as "mesophilic" dairy starter cultures. Associated with raw milk poor cooling. Some strains produce a "malty" defect in milk as well as acid defect.
Micrococcus spp.	Irregular clusters or tetrads, cells tend to be larger. Associated with udder skin. Some strains are thermoduric and are associated with milk-stone on equipment.
Staphylococcus aureus	Single, pairs or irregular clusters. A cause of contagious mastitis. May cause food poisoning (toxin developed) if present in high numbers in foods.
Streptococcus agalactiae	Chains, often very long. May appear as chains of pairs or with oval cocci stretched with the chain. Cause of contagious mastitis.
Streptococcus uberis	Pairs and chains of moderate length. Considered a cause of environmental mastitis, though some evidence suggests that it may/can be spread cow to cow.
Streptococcus salivarius sub-sp. thermophilus	Chains, moderate to long. Dairy "thermophilic" starter culture (incubation ~110°F) used for making yogurt and certain cheeses.
Gram-Positive Rods:	
Corynbacterium bovis	Irregular shaped rods, some "club" shaped. Cause of bovine mastitis though some strains may be natural inhabitants of the skin and mucosal membranes.
Lactobacillus delbrueckii sub-sp. *bulgaricus*	Long rods, some chains. Dairy "thermophilic" starter culture (incubation ~110°F) used for making yogurt and certain cheese.
Microbacterium lacticum	Irregular rods, some "V-Forms." Thermoduric bacterium, some strains with relatively high heat resistance for a non-spore-former.
Gram-Positive Rods, Spore-Forming:	
Bacillus cereus	Relatively large, thick rods. Some strains are psychrotrophic. Some strains cause foodborne illness if allowed to grow to sufficient levels (toxin mediated).
Bacillus spp.(others)	Many different spore-forming *Bacilius spp.* in milk Rods very in size. Some are psychrotrophic, some are not. Some are gram-variable. Most are thermoduric in the spore state, but not as vegetative cells. Common in soil & dairy environment.
Clostridium tyrobutyricum	Anaerobic spore-former that causes "late gas blowing" defect in certain Swiss and Dutch style cheeses. Associated with poor silage and dirty cows.
Paenibacillus spp	Spore-former group with psychrotrophic strains that are important as a limiting factor to milk shelf-life. Most were previously classified as *Bacillus* spp.
Gram-Negative Rods:	
Pseudomonas fluorescens (also *P. putida, P. fragi*)	Rods, often in pairs end-to-end. Psychrotrophic bacterium that is a main cause of reduced shelf-life due to post-pasteurization contamination.
Escherichia coli (*E. coli*)	"Fecal Coliform" associated with manure/environmental contamination. Used as an indicator organism. Some pathogenic strains (e.g., O157:H7). May cause mastitis.
Coliform Bacteria	*Enterococcus, Citrobacter, Klebsiella, E. coli.* Associated with fecal & environmental contamination. Some strains are psychrotrophic. Some may cause mastitis.
Others - Psychrotrophs	A number of gram-negative psychrotrophs are reported in older literature, including *Acinetobacter, Achromobacter, Flavobacterium.*

For listing of potential human pathogens see table on page 6 and refer to The Bad Bug Book (http://www.cfsan.fda.gov/~mow/intro.html)

BACTERIA IN RAW AND PROCESSED MILK

Bacteriological Standards: (For Grade "A" Milk)

Raw Producer Milk	100,000/milliliter (ml) total count
Commingled Raw Milk	300,000/ml total count
Pasteurized Milk	20,000/ml total count, 10 coliform

Raw Milk: Milk, when synthesized in the udder of a healthy cow is virtually sterile. As milk passes through the teat cistern and teat channel, it may be contaminated with low levels of bacteria (<1000/ml), which are generally not significant to milk quality & safety. Milk from a cow with mastitis (infection of the mammary gland) however, may harbor large numbers of the infectious bacteria. After it leaves the cow, milk may be contaminated from the exterior of the cow (dirty cows), the environment and poorly cleaned equipment. Poor cooling allows faster growth rates and can result in rapid increases in bacterial numbers in raw milk before it is processed. While the legal limit for bacteria in raw milk is 100,000/ml, the production of milk with bacteria counts less than 10,000/ml should be easily achievable for most farms.

Pasteurized Milk: Pasteurization, while designed to destroy potential pathogens in raw milk, substantially reduces the total numbers of bacteria present, increasing the shelf-life potential of the milk. Unless gross recontamination has occurred, bacterial numbers in fresh pasteurized milk generally reflect the organisms that survive pasteurization (thermoduric). The legal limit for bacterial numbers in pasteurized milk is 20,000/ml, though bacteria counts for most fresh pasteurized milks are generally less than 1,000/ml. Under proper refrigeration, the bacteria that become significant in the shelf-life and spoilage of milk are psychrotrophic in nature. These types of organisms generally occur as post-pasteurization contaminants, although a few thermoduric bacteria may be psychrotrophs.

Sources of Bacteria in Processed Milk:

1) Survive pasteurization (thermoduric).
2) Post-Pasteurization Contamination:
   a) Insufficient cleaning/sanitizing - valves, pipelines, gaskets, pasteurized milk tanks, fillers.
   b) Personnel - hands, clothing, sneezes, coughs.
   c) Environmental - air, dust, water, condensate.

CONTROLLING BACTERIAL CONTAMINATION & DEFECTS IN DAIRY PRODUCTS

Preventing Contamination:

Bacteria are present in the environment both at the farm and at the dairy plant. Although total prevention of microbial contamination of milk at the farm is impossible, it can be minimized by milking clean, healthy cows; in a clean environment and by assuring that the milking system and storage equipment is properly cleaned, sanitized and maintained. Once raw milk leaves the farm (tank truck to plant storage) it must be properly handled to prevent further contamination before it is processed. Keeping the microbial load of raw milk to a minimum will increase the quality of the products made. At all stages of raw milk handling, milk must be rapidly and properly cooled with temperatures maintained below 40°F (4.4°C).

At the dairy plant, preventing contamination after pasteurization is critical for product shelf-life and safety. This requires that the processing equipment and the plant environment be thoroughly cleaned and sanitized such that the possibility of microbial growth and contamination is limited. Once cleaned and sanitized, recontamination should be prevented. Proper employee training in dairy and personal hygiene procedures should be an essential part of every plant's quality assurance program

Preventing or Slowing Microbial Growth:

Microbial growth can be controlled by: 1) eliminating sources of "bacterial food" by thoroughly cleaning the milk handling equipment and the environment, thus eliminating milk residues and other sources of microbial nutrition, at the farm, during transit and at the plant; 2) holding raw milk and dairy foods well below the optimum growth temperature of bacterial contaminants, generally less than 40°F (4.4°C) without freezing; 3) lowering the pH such as in cultured dairy products; 4) reducing the moisture or water activity (A_w) such as in dry milk products; and 5) adding microbial inhibitors or preservatives such as is done with potassium sorbate addition to cottage cheese.

Eliminating or Killing Contaminants - Sanitation Procedures:

Chemical sanitizers are routinely used to reduce the load of microbial contaminants that may be present on milk/food contact surfaces. Most dairy sanitizers, when used correctly, kill off a broad spectrum of microorganisms. Sanitization procedures should be performed after washing and immediately before processing, although an additional sanitizing step after equipment washing procedures can be helpful. Most chemical sanitizers are inactivated by organic matter and are ineffective on poorly cleaned surfaces. Sanitizers commonly used in the dairy industry include chlorine and iodine compounds, quaternary ammonium compounds, acid anionics & peroxyacetic acid.

Hot water sanitization is commonly used in many dairy plants. Hot water sanitization involves circulating water of at least 170°F (determined at the outlet) for at least 5 minutes. Higher temperatures (>185°F) for longer times (10-15 minutes) are recommended to allow heat penetration into areas that are hard to reach. Hot water treatments should be followed by a cooling chemical sanitizer rinse or with cooled pasteurized water. Hot water will often provide greater kill and longer milk shelf-life than can be achieved with chemical sanitizers alone.

Eliminating or Killing Contaminants - Pasteurization:

Pasteurization procedures generally kill a large percentage of the bacteria commonly found in raw milk, including pathogenic organisms and those that rapidly cause spoilage. The higher the temperature used, the less time is required for equivalent kill. The most commonly used defined minimum temperature/time combinations are:

Batch Pasteurization:	63°C (145°F) for 30 minutes
High-Temperature/Short-Time:	72°C (161°F) for 15 seconds.

These procedures stand as legal definitions of pasteurization and are outlined in the "Pasteurized Milk Ordinance," the document of requirements for Grade "A" milk products. A majority of dairy plants use High-Temperature/Short-Time pasteurization, with temperature/time combinations often exceeding the stated minimum requirement (i.e., 170°F for 20 seconds). Most bacteria that survive pasteurization generally do not grow or else grow slowly at refrigeration temperatures, causing problems later in shelf-life. Contamination after pasteurization with psychrotrophic spoilage bacteria is not uncommon. When post-pasteurization contamination of a product occurs, both the quality and the safety of the product are jeopardized.

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Brock, T.D., & M.T. Madigan. 1986. Biology of Microorganisms. Prentice Hall, Englewood Cliffs, NJ. FDA-CFSAN. The Bad Bug Book; available at: http://www.cfsan.fda.gov/~mow/intro.html ; Jay, J.M. 1996. Modern Food Microbiology. Chapman & Hall, NY, NY. Robinson, R.K. ed. 2002. Dairy Microbiology Handbook. J. Wiley & Sons, NY, NY

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RESPONSE TO THE FDA

A Point-by-Point Rebuttal to the Anti-Raw Milk Powerpoint Presentation By John F. Sheehan, BSc (Dy), JD, Division of Dairy and Egg Safety

Prepared by
The Weston A. Price Foundation
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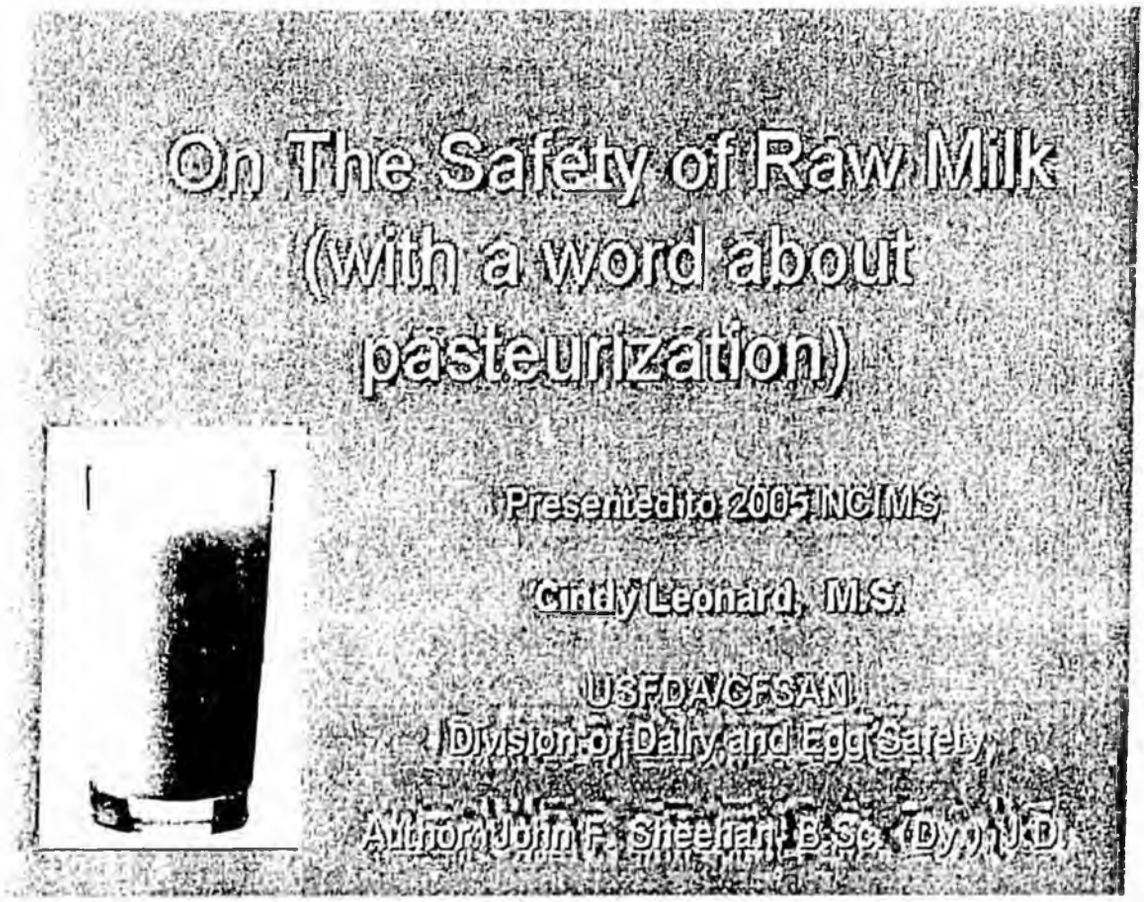
Page numbers

Slide 1
http://www.cfsan.fda.gov/~ear/milksafe/milksa1.htm

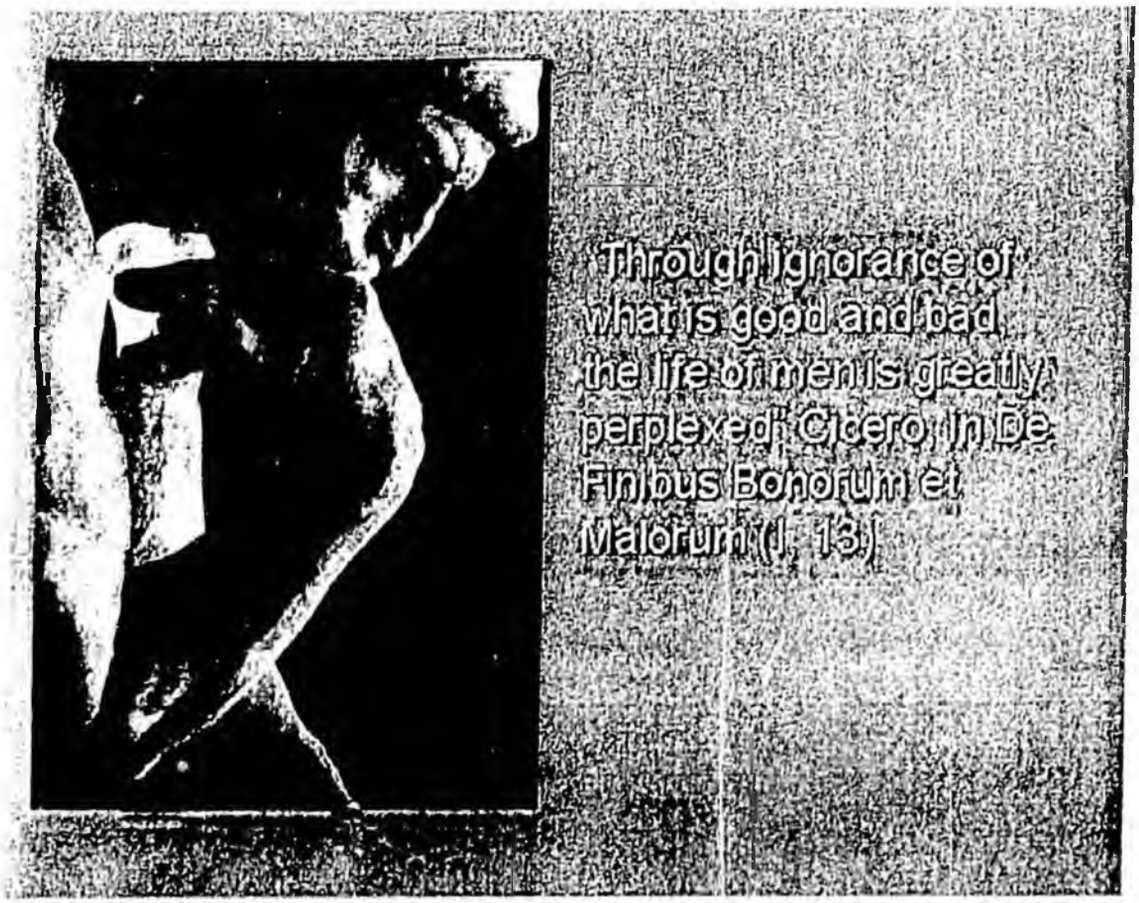


The FDA begins by making two important mistakes: addressing the safety of raw milk outside of the context of general food safety and addressing pasteurization as the only means of making milk safe.

That the consumption of raw milk carries some risk is undeniable. The question is whether raw milk carries a unique risk that distinguishes it from other foods ordinarily consumed – such as pasteurized milk, produce, hot dogs, or deli meats. The FDA does not make this comparison.

The second question that must be addressed is how milk can best be made safe. The FDA considers pasteurization the only option and ignores other measures such as improved sanitation and pasture-based farming.

Slide 2
http://www.cfsan.fda.gov/~ear/milksafe/milksa2.htm



The saying is true. Yet we may also be greatly perplexed through failure to recognize important nuances or to fully consider all possibilities. Seeing pasteurized milk as "good" and raw milk as "bad" ignores the drawbacks of pasteurization, fails to acknowledge the differences in the quality and safety of raw milks produced by different procedures and leaves the question of how to safely reap the benefits of raw milk unanswered.

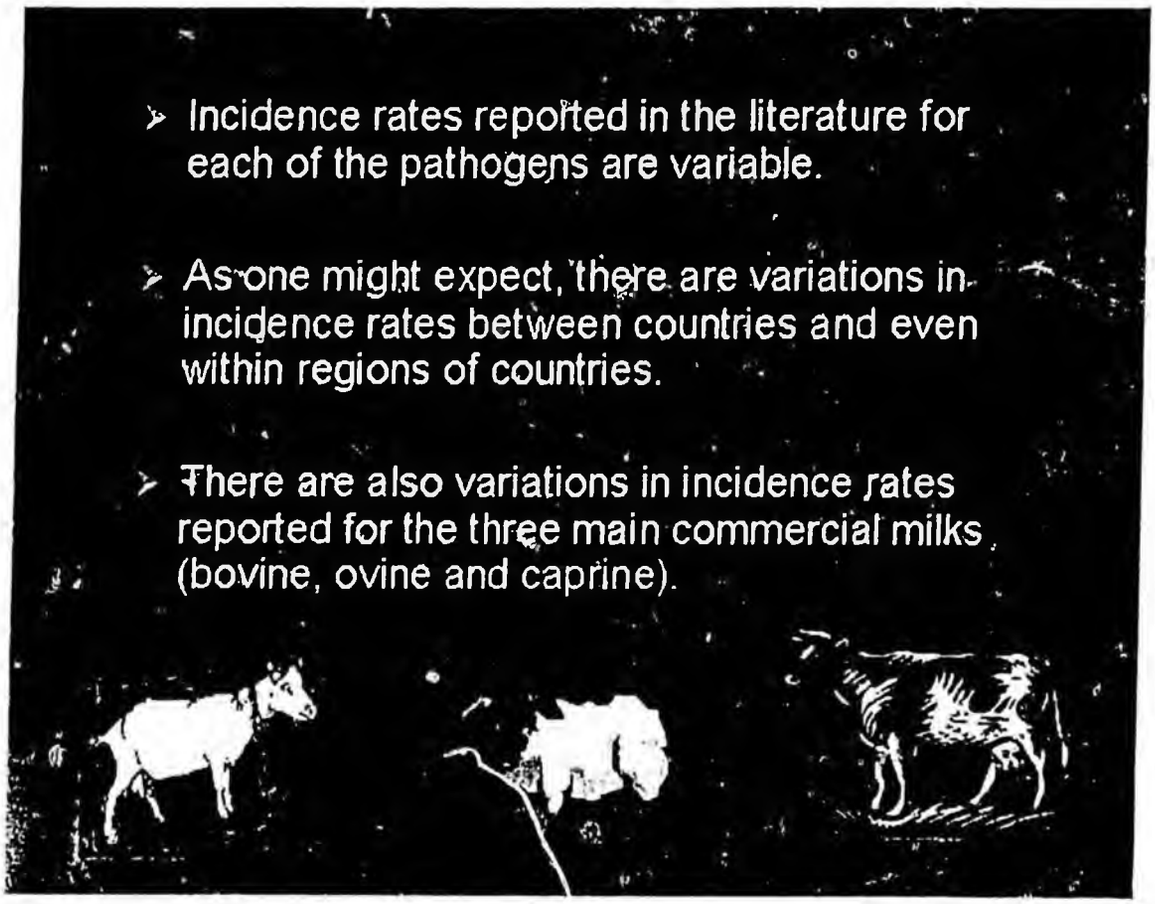
Slide 3
http://www.cfsan.fda.gov/~ear/milksafe/milksa3.htm

The consumption of all foods, including milk – whether pasteurized or unpasteurized – inherently carries some degree of risk. Some organisms or their associated toxins can survive the pasteurization process; these and others can also contaminate milk after it has been pasteurized. **Pasteurized milk may contain a whole host of pathogens and associated toxins, including:**

- *Staphylococcus aureus enterotoxin A*
- *Salmonella species*
- *Escherichia coli*
- *Listeria monocytogenes*
- *Mycobacterium paratuberculosis*
- *Bacillus species*
- *Clostridium species*
- *Yersinia entercolitica*

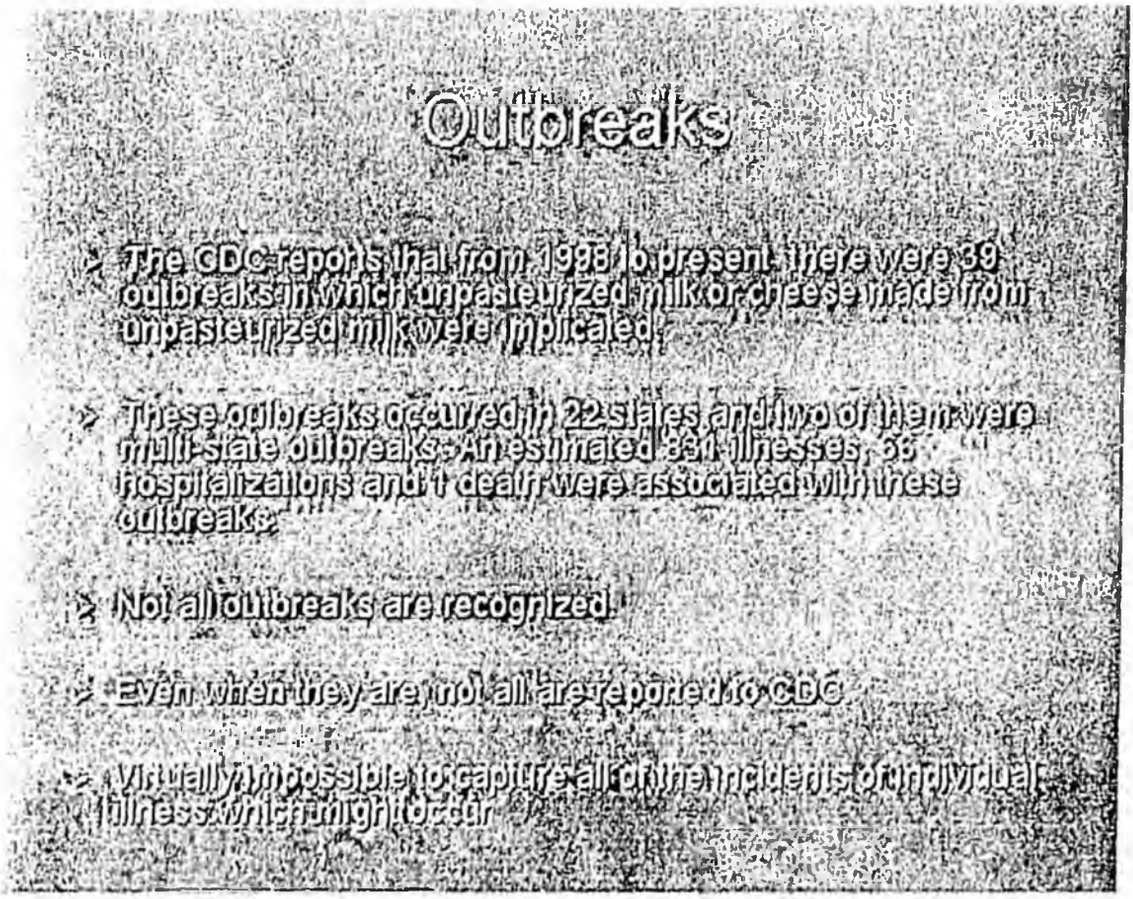
These and other pathogens may also occur in many other foods.

Slide 4
http://www.cfsan.fda.gov/~ear/milksafe/milksa4.htm



Incidence rates for outbreaks associated with pasteurized milk, eggs, beef, game, pork, poultry, fish, shellfish, grains, fats and oils, processed foods, vegetables, fruits, and nuts also exist and exhibit similar variation.

Slide 5
http://www.cfsan.fda.gov/~ear/milksafe/milksa5.htm



These figures mean that raw milk products are implicated in 92 illnesses per year, seven hospitalizations per year, and one death every nine years.

Between 1998 and 2005, there were over 10,000 documented outbreaks that contributed to 199,263 documented cases of foodborne illness. Raw milk was associated with 0.4% of these cases.

While some illnesses due to raw milk may go unreported, the same is true for pasteurized milk and all other foods.

Cases of foodborne illness are investigated with a systematic bias against raw milk. Many outbreaks in which raw milk has been "implicated" are almost certainly attributable to another cause.

Slide 5 Response Continued

Sources of Bias

As we review the cases of foodborne illness attributed to raw milk, we must take note of the following sources of bias:

- Some questionnaires used in investigations of foodborne illness ask about many foods and some ask about only a few – but *all* ask about raw milk.

- Often, equally likely or more likely sources of infection – such as hot dogs in the case of *Listeria* – are ignored when investigators discover that some of the patients had consumed raw milk products.

- In many instances, case-control studies are used to show that those who became ill were statistically more likely to use raw milk than those who did not become ill. While this is valid grounds for *hypothesizing* that raw milk is to blame, it is not valid grounds for confirming it. Nevertheless, investigators often claim that raw milk caused an outbreak on this basis alone, even when all milk samples tested negative for the organism.

Slide 5 Response Continued

More Sources of Bias

- Since the availability of raw milk is limited, its consumption can often be a marker for visits to specific farms, purchases from specific street vendors, or associations with specific groups of people. Because organisms that cause foodborne illness can also be spread through contact with animals, animal manure, infected people, and other foods prepared by infected people, statistical associations with raw milk may arise in cases where the actual cause of the outbreak is contact with animals or their manure, person-to-person contact, or the consumption of other foods sold by raw milk product street vendors.

- Although people can acquire an infection from consuming milk and cheese, infected people can also spread an infectious organism to uncontaminated milk, cheese, and other foods by drinking milk out of the container and biting into or handling other foods. Demonstrating that leftover cheese or milk is contaminated, then, means very little if it is not also demonstrated that products from the original source are contaminated with the same strain.

- Milk products can become contaminated at many different points over the course of their production, both before and after pasteurization. Cheese products can become contaminated during the cheese-making process, especially if the facility and implements are not properly sanitized and separated from other sources of contamination, such as raw meats.

- For this reason, even in cases where an outbreak is genuinely traced to a raw milk product, the question must be asked: "Would pasteurization have prevented this outbreak?"

- Often times the answer is, "We don't know," or simply, "No."

Slide 5 Response Continued

Seeing It All in Perspective

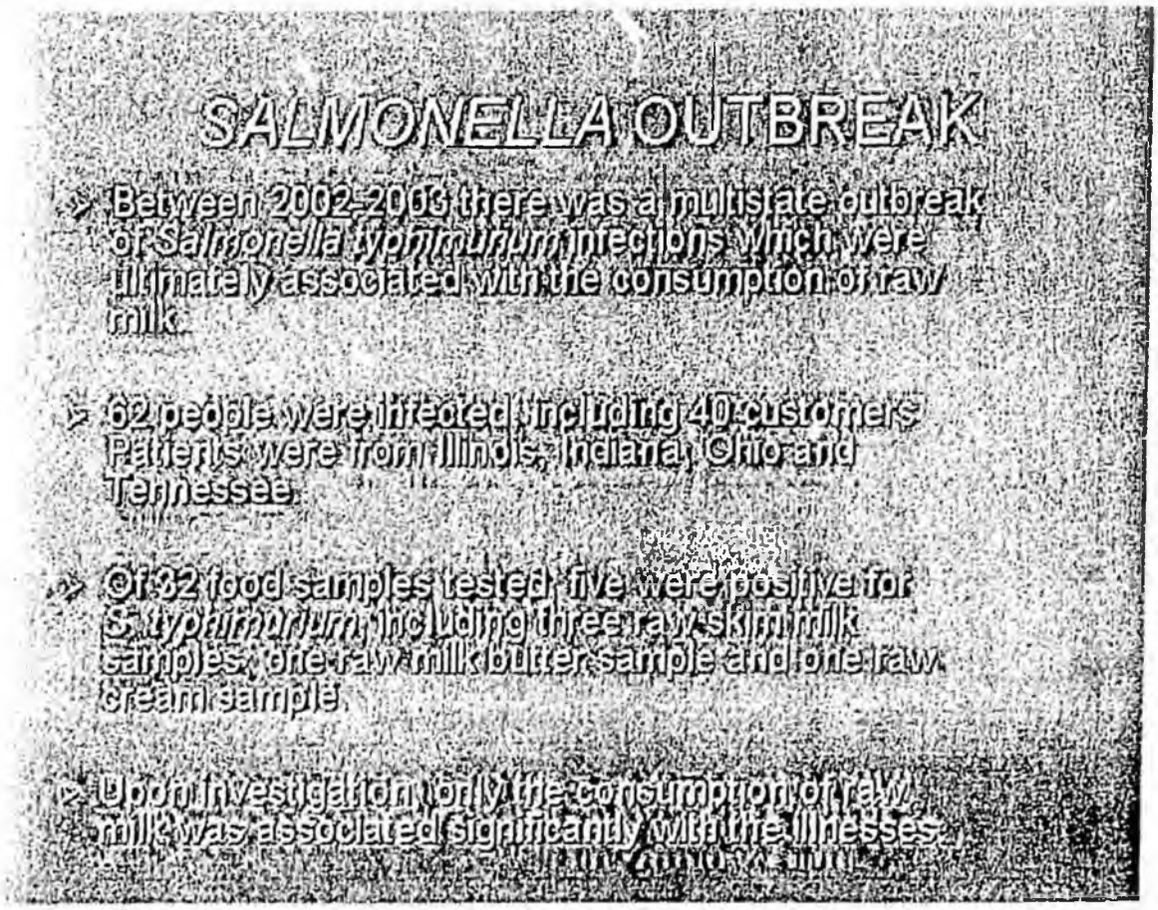
Finally, we must always evaluate the safety of raw milk within the context of general food safety. All foods – as well as water, household or public surfaces, and various inanimate objects – carry some risk of contamination. The questions we must ask, however, are the following:

- How does the safety of raw milk compare to that of pasteurized milk?
- How does the safety of raw milk compare to that of other commonly consumed foods, such as fresh produce, deli meats, or hot dogs?
- How does the approach of the FDA and other federal and state agencies to the safety of raw milk compare to their approach to the safety of these other foods? Are these approaches fair and in the interest of the consumer?

Keeping these questions in mind, let us review the cases of foodborne illness attributed to raw milk that the FDA presents.

Slide 7 (Slide 6 is a picture)

http://www.cfsan.fda.gov/~ear/milksafe/milksa7.htm



All 31 stool samples taken from dairy cows tested negative. Only products made from skim milk or the cream separated from it tested positive. **The milk was probably contaminated during processing.**

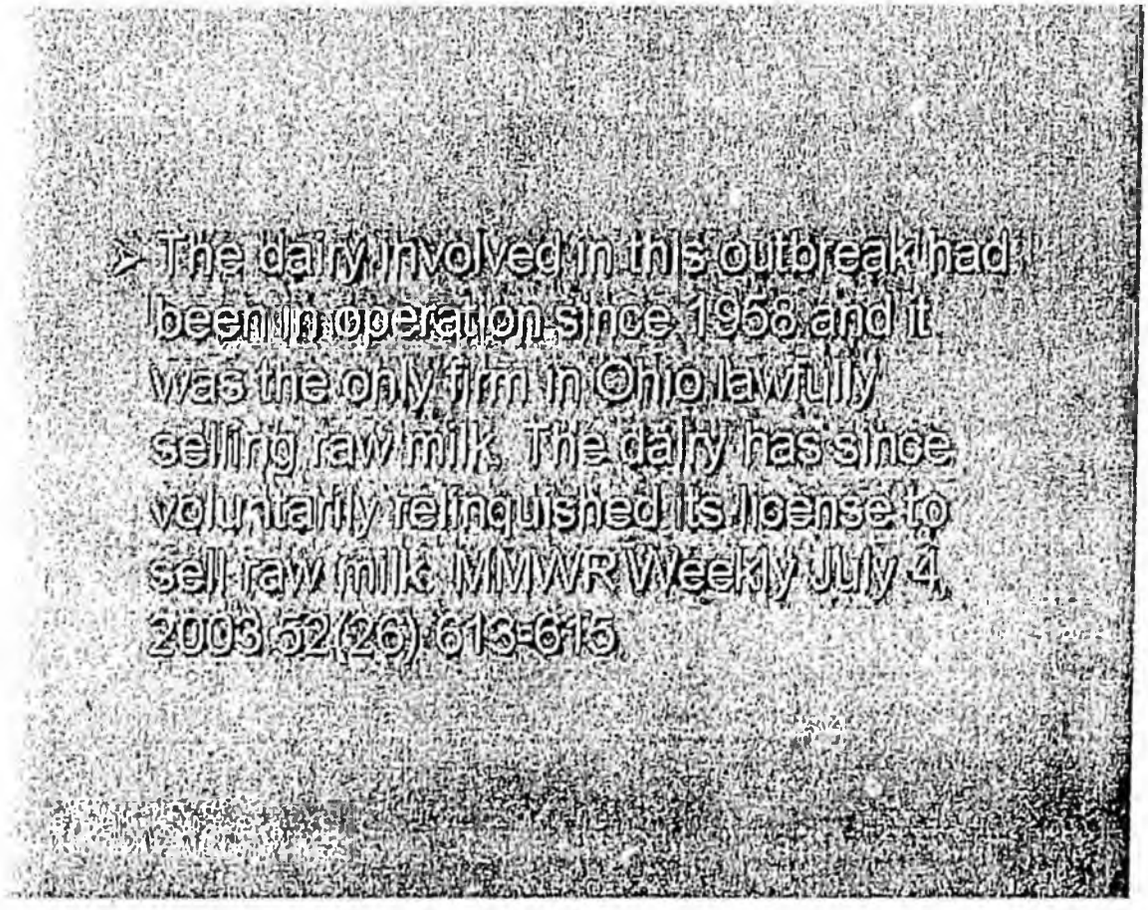
The Clark County Health Authorities concluded on January 15, 2003 – one day before the farm relinquished its license to sell raw milk – "We . . . cannot say as to whether or not pasteurization would have prevented this outbreak."

The farm had no established program for evaluating milk quality. The Ohio Department of Agriculture recommended a number of sanitation improvements and repairs in addition to the cessation of raw milk sales.

Whether the recommended sanitation improvements and repairs and the establishment of a program for evaluating milk quality could have allowed the safe production and sale of raw milk was never investigated.

Slide 8

http://www.cfsan.fda.gov/~ear/milksafe/milksa8.htm



On December 13, 2002, the Clark County Health Authorities ordered the farm to discontinue the sale of raw milk products in its food service areas. On December 23, 2002, the Ohio Department of Agriculture (ODA) temporarily ordered the farm to discontinue the retail sale of bottled milk and milk products. On January 13, 2003, the ODA informed the farm that the "temporary" stop-sale order would remain in effect "until further notice" and recommended that the farm voluntarily relinquish its license. Three days later, the farm did so.

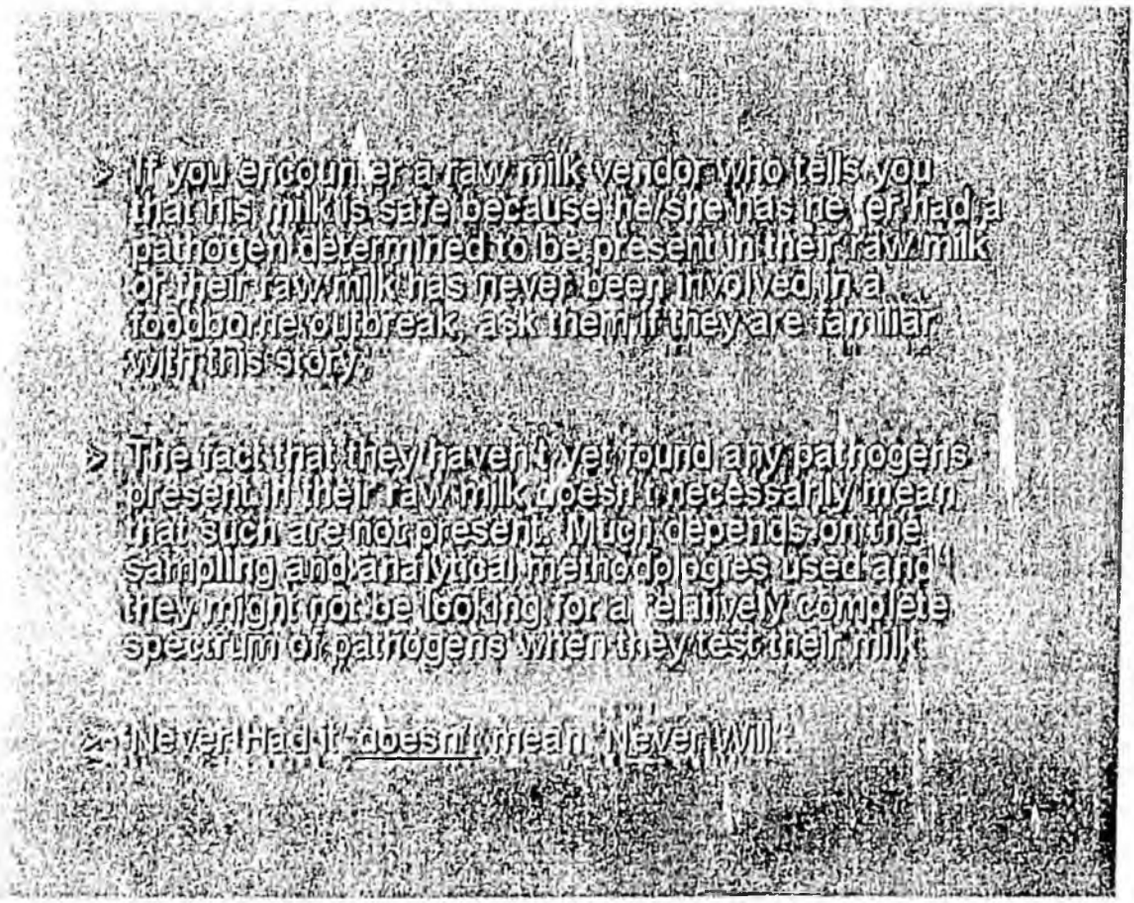
The farm was serving 1.35 million customers per year.

The outbreak, involving 40 customers, was much smaller than outbreaks of *Salmonella* that have resulted from contaminated pasteurized milk.

Unfortunately, the authorities were more interested in closing down the state's last raw milk dairy than working with the farm to make its raw milk safe by improving sanitation and quality control.

Slide 9

http://www.cfsan.fda.gov/~car/milksafe/milksa9.htm



In 1985, there was a multi-state outbreak of antibiotic-resistant *Salmonella typhimurium* traced to pasteurized 2% milk from a Chicago milk plant.

Over 16,000 culture-confirmed cases were documented in seven states, and the researchers estimated that between 150,000 and 200,000 people had been affected. It was the largest outbreak of *Salmonella* in the nation's history.

If you encounter raw milk opponents who tell you that pasteurized milk is inherently safer than raw milk because pasteurization destroys *Salmonella,* ask them if they are familiar with this story.

Response Slide to Slide 9 Continued

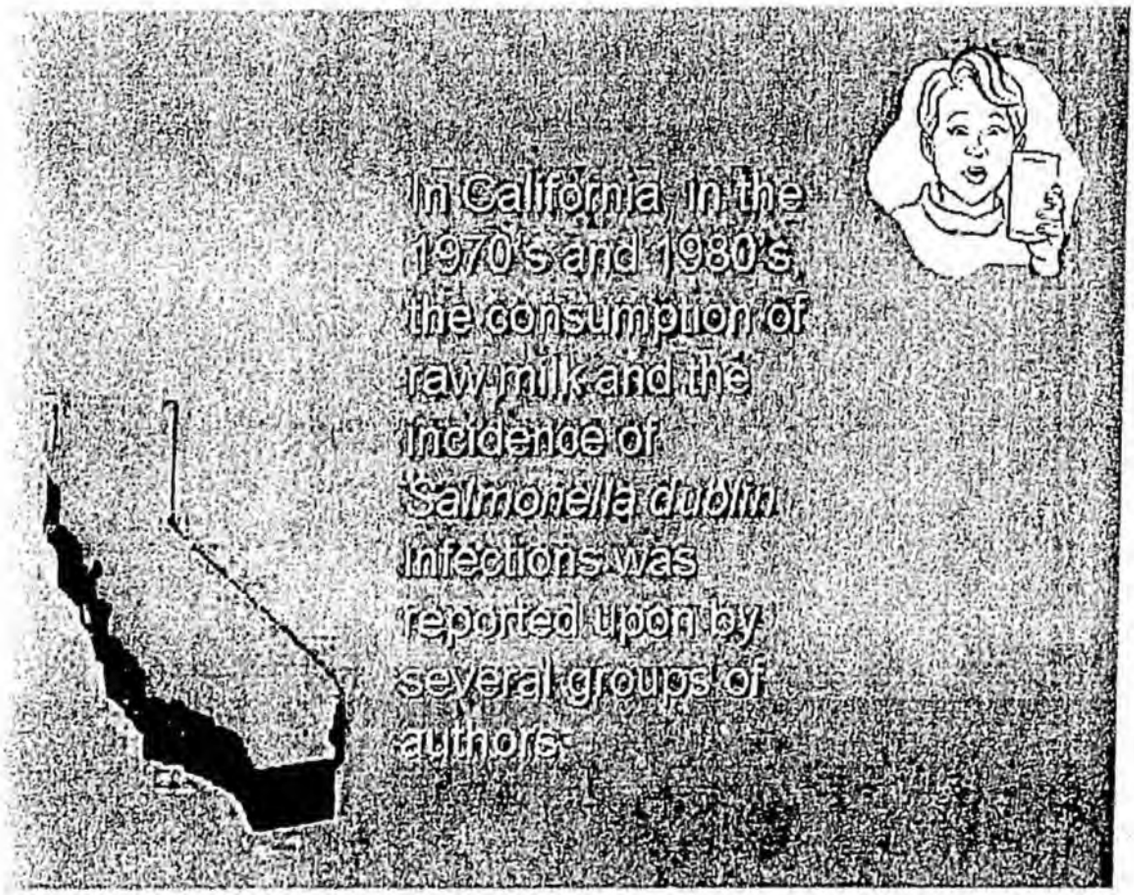
A more recent multi-state outbreak of antibiotic-resistant *S. typhimurium* in April, 2000 implicated **pasteurized** milk from a Pennsylvania dairy plant. There were 38 culture-confirmed cases.

The investigation of the plant revealed that pasteurization was adequate, but bacteria counts in the milk were elevated up to six-fold above the legal limit. The authors of the report noted that "inadequate pasteurization is a relatively uncommon event compared to contamination after pasteurization."

The plant hired an outside consultant to help it meet FDA standards and the Pennsylvania Department of Agriculture integrated employee training with its routine inspections.

No one suggested that pasteurized milk was inherently dangerous or tried to close down the plant.

Slide 10
http://www.cfsan.fda.gov/~ear/milksafe/milksa10.htm



These reports were published against the historical backdrop of a concerted effort on the part of California health authorities to push the state's largest raw milk producer, Alta Dena Dairy, out of business. The dairy was selling 20,000 gallons of raw milk per day. A timeline of this effort will help us view these reports in the proper context:

- In 1965, the San Diego County health officer banned raw milk because he supposedly found *Staphylococcus aureus* in Alta Dena milk. The ban stood against the will of the County Board of Supervisors for three years until the 4th District Court of Appeals removed it. **No one ever got sick from *S. aureus*.**

- In 1966, the Los Angeles County Department of Health Services reported seven cases of Q fever (*Coxiella burnetti*) among people who lived "in or around dairies." **Although the illness is contracted through inhalation and none of those who fell ill had drunk raw milk, the Department concluded that the most practical solution was the universal pasteurization of milk.**

Slide 10 Response Continued

- In 1969, the department banned Alta Dena milk throughout the county, claiming that some samples were contaminated with *C. burnetti*. No one got sick, and the dairy continued sales. The owners were found in contempt of court, but **the charges were dropped** when expert witnesses testified that Q fever was contracted through inhalation upon close contact with animals rather than through drinking raw milk.

- In 1974, the California Department of Health Services issued a statewide ban on Alta Dena milk, citing the threat of brucellosis. Alta Dena's dairy herd had been vaccinated against this disease and was routinely tested for it. **No brucellosis had been found.** The owners went to court again, retested the herd, and the ban was dropped.

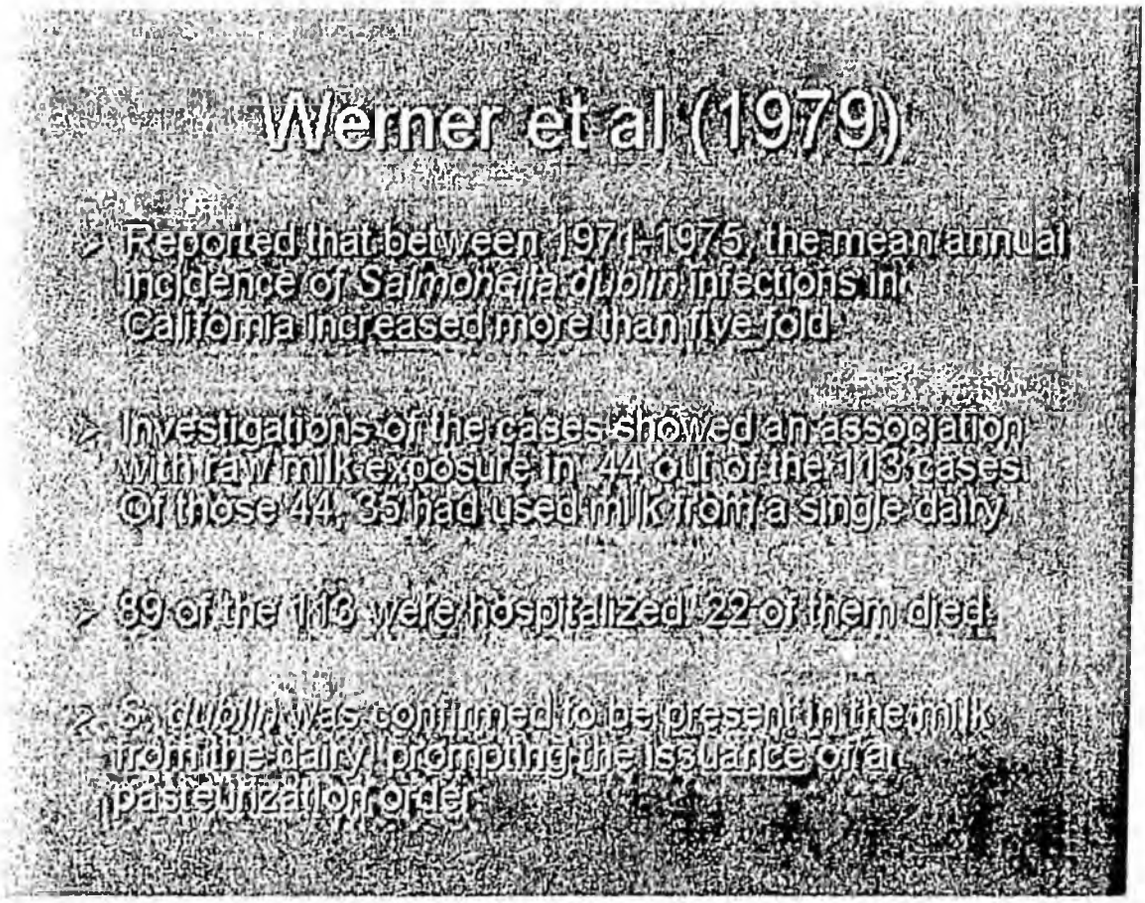
- In the mid-1970s, the state made numerous claims that *Salmonella* was found in Alta Dena milk.

- In 1978, the owners of Alta Dena led raw milk producers in support of a state Senate bill that would introduce state oversight of raw milk production similar to its oversight of the production of other foodstuffs. Two days before the Senate debate began, the state alerted media outlets to an imminent *Salmonella* outbreak. **The state lab claimed to find *Salmonella* in Alta Dena milk but two independent laboratories could not replicate the finding.**

- The following year, scientists working for the Infectious Disease Section of the California Department of Health Services published a report in the *British Medical Journal* claiming to link *Salmonella dublin* from Alta Dena milk to the deaths of cancer patients. This report will be discussed in the following slides.

Slide 11

http://www.cfsan.fda.gov/~ear/milksafe/milksa11.htm



The authors reported that 31% of the patients had used raw milk from "dairy X" (Alta Dena), but did not compare this group to a control group.

According to the report, many of the severely ill patients were using the milk precisely to treat their illness. We should expect the rate of raw milk consumption among the severely ill patients to have been higher than that among age-matched controls for this very reason, although the authors presented no evidence that this was the case.

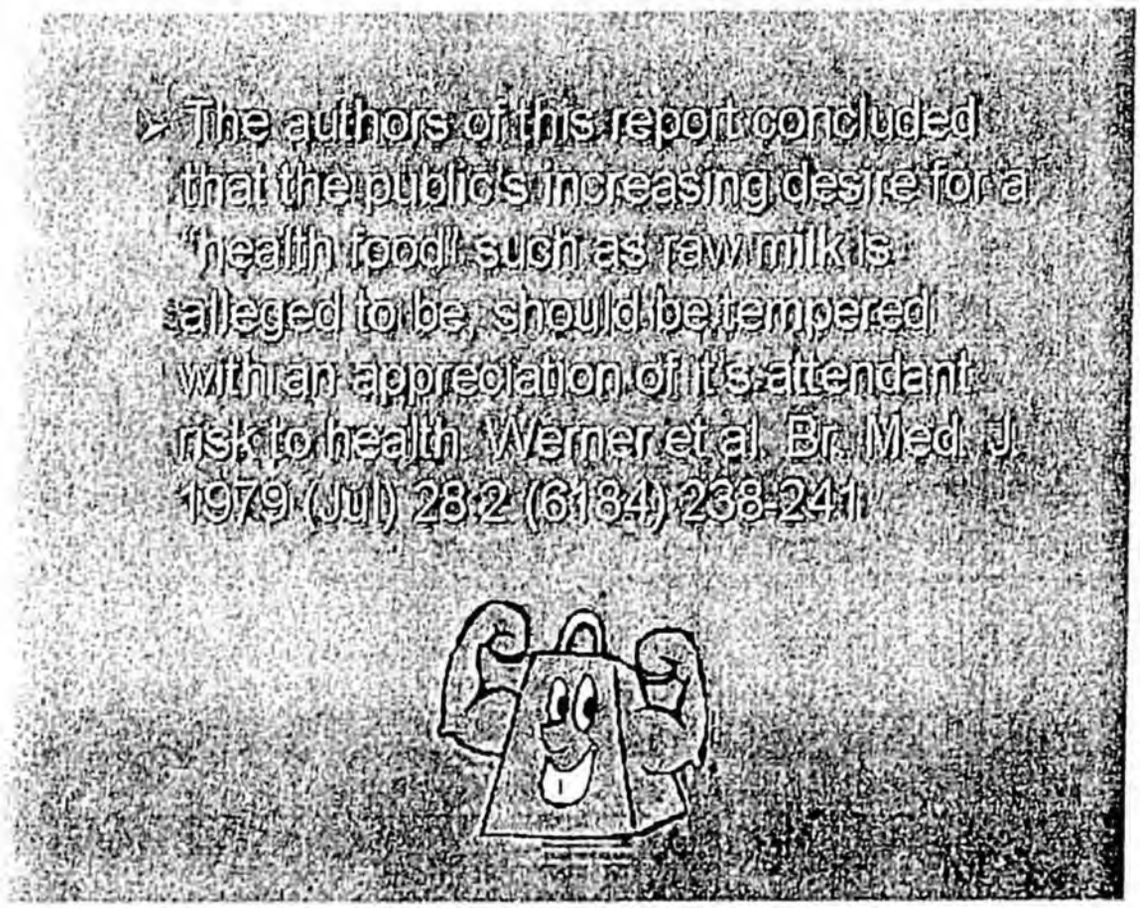
The authors reported that the deaths owed to the seriousness of the patients' underlying diseases, such as leukemia and lymphoma, and regarded "the *S. dublin* infections as an associative feature in their death but not necessarily the underlying cause."

Response to Slide 11 Continued

The authors claimed to find *S. dublin* in one out of 98 quarts of Alta Dena milk tested, but did not find the organism in the feces of any of the dairy animals. They presented no evidence that infected patients were more likely to have drunk Alta Dena milk than anyone else, nor an explanation of how the 69% of patients who had not drunk the dairy's milk became infected.

The pasteurization order was issued in April, 1974. There were no cases of infection "associated" with the dairy before the order in March, but three cases after the order went into effect between April and June. **The authors presented no evidence that the pasteurization order had any effect on the occurrence of *S. dublin* infections.**

Slide 12
http://www.cfsan.fda.gov/~ear/milksafe/milksa12.htm

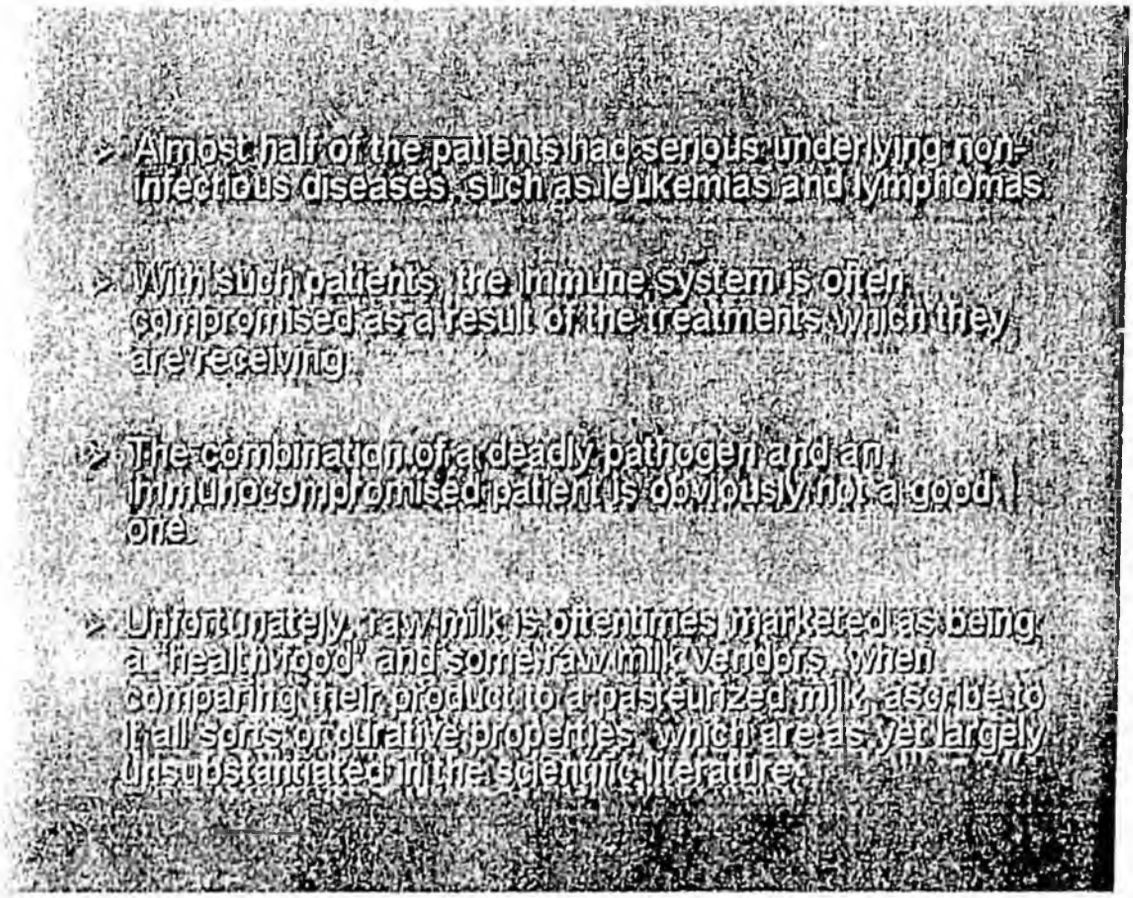


That the authors used the words "health food" in quotation marks reveals that they did not take the potential benefits of raw milk seriously. Although they noted "the large public demand for raw milk that exists in California" and the consequent unlikelihood "that its sale will be prohibited," they offered no scientific evaluation of the health claims of raw milk proponents in either the introduction or the discussion of the study.

The authors noted that fecal contamination and mastitis were the primary causes of *Salmonella* contamination of milk, but offered no suggestions for reducing these factors.

Although the public should understand that *Salmonella* can contaminate both raw and pasteurized milk, health authorities should look beyond pasteurization as the only protection and help raw milk farmers pursue practices that reduce fecal contamination and mastitis, such as proper sanitation and grass-feeding, in order to make raw milk safely available to those who wish to consume it.

Slide 13
http://www.cfsan.fda.gov/~ear/milksafe/milksa13.htm



Much of the research demonstrating the health benefits of raw milk was conducted prior to the 1960s and is therefore not indexed in databases such as *PubMed*. Modern experimental methods, tools of biochemical analysis, and methods of pasteurization are needed to reevaluate the question to the satisfaction of academic scientists and policy experts – but there is a large gulf between something that is "as yet largely unsubstantiated" and something that has been refuted. The former implies that the claims have been partially substantiated and may be fully substantiated in the future.

Many people who consume raw milk rely on anecdotal evidence of its superiority, including but not limited to their own experiences. Although anecdotal evidence is not sufficient to confirm a hypothesis, it is a valid means for generating one. Whether it is sufficient means for *acting* on one is a personal decision that every individual should have a right to make.

In the second part of this presentation, we will show that **many of the health claims that the FDA labels "myths" are actually substantiated in today's scientific literature** and that much of the older research showing the superiority of raw milk still stands.

Slide 14
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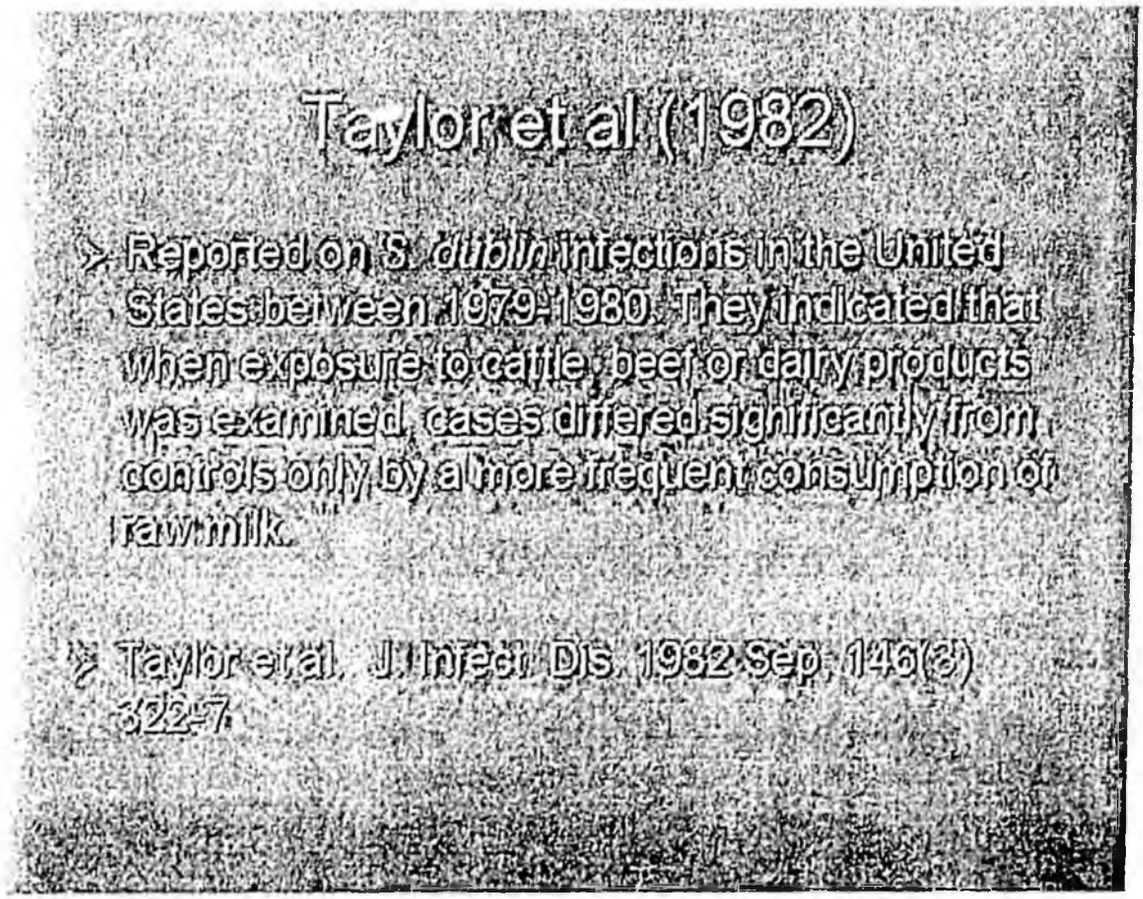


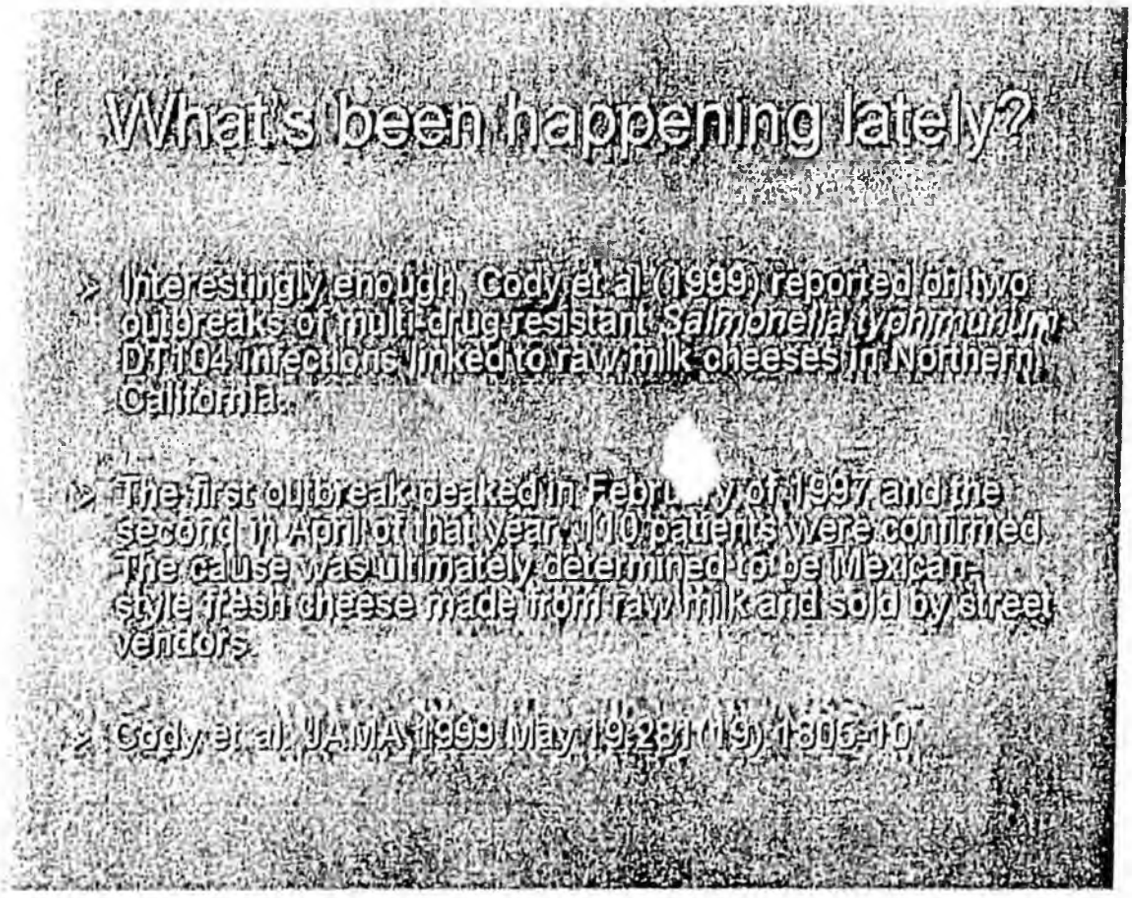
Eight out of twelve subjects who drank raw milk obtained it from "a local farm that was not intended for commercial sale." The authors made no investigation of the sanitation or feeding methods at these farms.

In 38% of the cases the patients "drank raw milk in the two weeks before they became ill," whereas in only 8% of the controls the subjects "drank raw milk the week before [the case patient to whom they were matched] became ill." **The authors did not explain why they compared two-week exposure in the case group to one-week exposure in the control group.** These statistics may therefore be invalid.

Antacids were used by 19% of cases and anti-microbial agents were used by 16% of cases. Half suffered from chronic illnesses such as diabetes, peptic ulcer, or cancer.

No raw milk samples were tested for *S. dublin*.

Slide 15
http://www.cfsan.fda.gov/~ear/milksafe/milksa15.html



In the first outbreak, a case-control study found that 94% of cases and 58% of controls had eaten "fresh Mexican-style cheese" in the week before illness, and that 53% of cases and 9% of controls had attended a specific local flea market.

None of the patients had cheese left over for sampling.

The cheese was purchased mostly from Hispanic specialty markets, not street vendors. The California Department of Food and Agriculture tested fresh Mexican-style cheeses from 16 of these markets. Although it found that 25% of them sold cheese demonstrating "incomplete pasteurization of milk," **none of the cheese tested positive for *S. typhimurium*.**

Murthy and Cox (1988) showed that the test used gives false positives because of enzymes produced by the microbes that ferment Mexican-style soft cheese.

There was no direct evidence that the cheese eaten was made with raw milk or that it caused the outbreak.

Slide 15 Response Continued

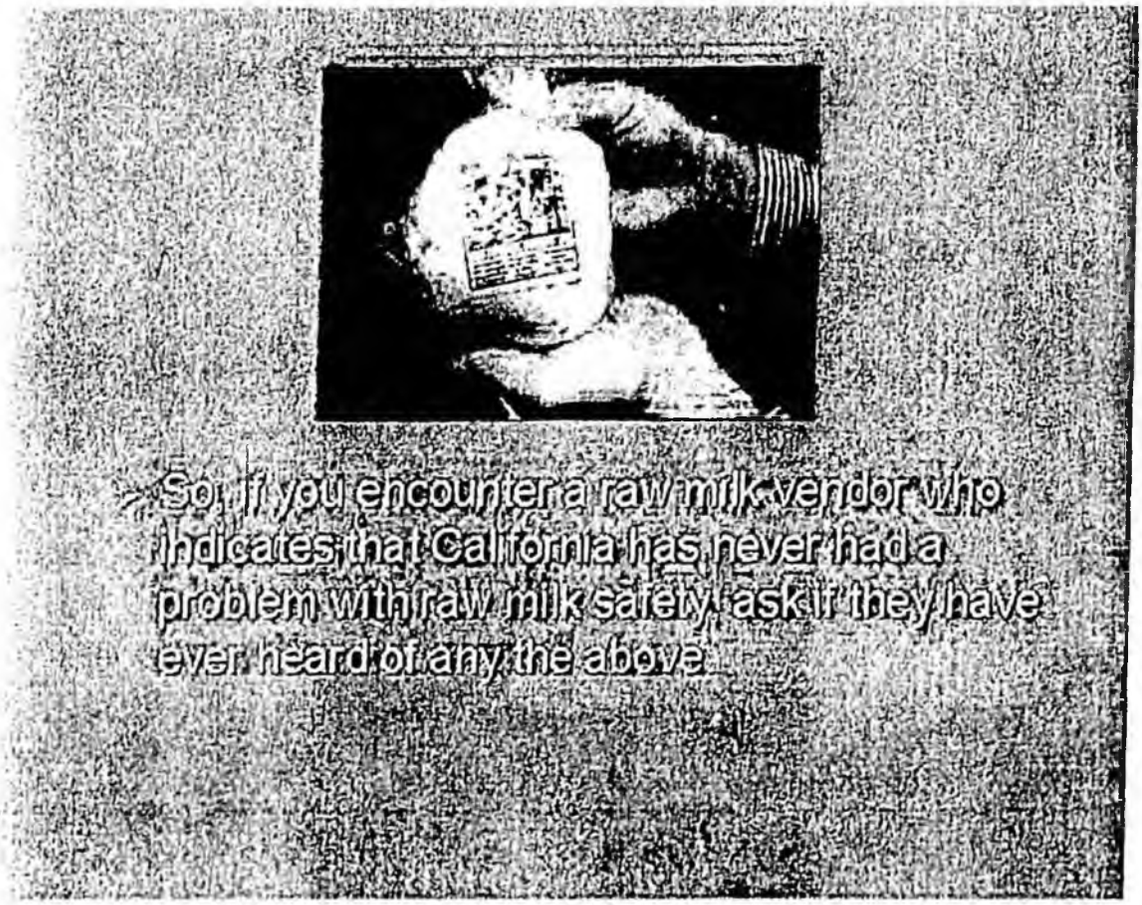
In the second outbreak, a case was defined as someone "who had eaten fresh, Mexican-style cheese in the week before illness onset." No case-control study was performed.

Cheese testing positive for *S. typhimurium* was obtained from ten out of 51 infected households. In two of these ten cases, the cheese was traced back to the street vendor who sold it.

Only one vendor's cheese tested positive for *S. typhimurium.* It was made from raw milk in the vendor's home kitchen. Although a sample of milk from the dairy that supplied it also contained *S. typhimurium*, it was a different subtype than the one found in the cheese made with it. The authors concluded that the milk may have been contaminated with multiple subtypes that they failed to detect.

Since *S. typhimurium* is also spread by chicken, pork, beef, salami, and sausages, however, it may well have come from the cheese vendor's kitchen counter.

Slide 16
http://www.cfsan.fda.gov/~ear/milksafe/milksafe.htm



The vendor might make the following replies:

- A person may become infected with *Salmonella* by eating cheese, but a person infected by another source could also spread *Salmonella* to the cheese through handling it or biting into it.
- **In the first outbreak, no cheese was traced to contaminated raw milk; in the second outbreak, less than two percent of infected households had cheese traceable to contaminated raw milk.** Even if the subtypes had matched – which they did not – 99% of the cases would be left unexplained.
- There are many opportunities for cheese to be contaminated even if the milk is pasteurized – especially if the cheese is made in a home kitchen. Education, training and oversight can all be used to ensure the provision of safe raw milk cheese.

Slide 17
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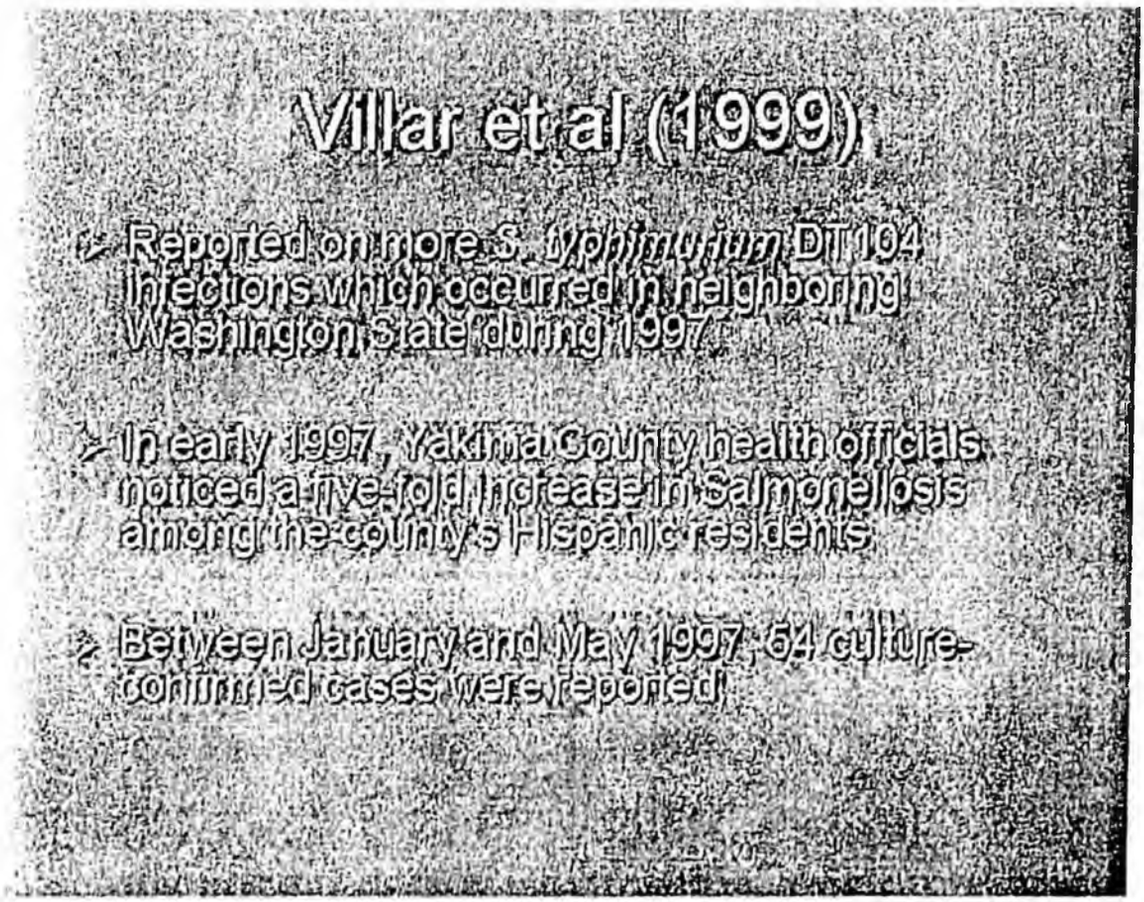
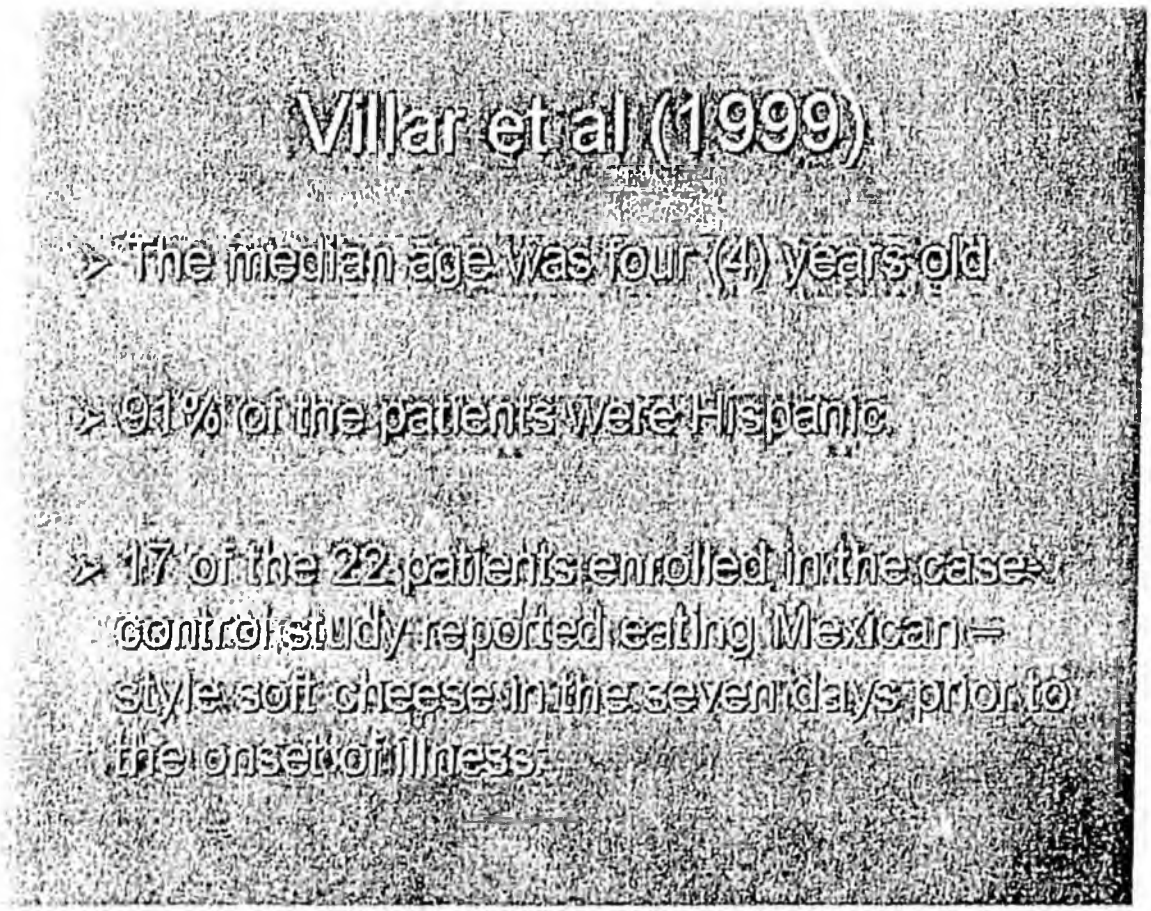


According to the authors, anecdotal reports suggested that this rise paralleled the rise in consumption of fresh, Mexican-style soft cheese (*queso fresco)* and returned to previous levels after the institution of a safe cheese-making education program. There were no citations for the anecdotal reports. If the rise and fall of *S. typhimurium* did indeed parallel these changes, it would suggest that the cheese may have been a source of infection. As we will see in coming slides, however, there is no evidence tracing the problem to raw milk.

Slide 18
http://www.cfsan.fda.gov/~ear/milksafe/milksa18.htm



The illnesses occurred between January 1 and May 5, 1997. The case-control study was conducted later in May and the interviewer was not blinded to the case or control status of the interviewee. The authors wrote, "The time delay from when illnesses began and when we initiated the investigation may have contributed to recall bias. However, it is unlikely given the study design that this bias would have been selective for raw-milk Mexican-style soft cheese."

News reports of the putative association between *S. typhimurium* and Mexican-style soft cheese in California, however, began in April of 1997.

While 77% of cases and only 28% of controls reported eating such cheese a week before their illnesses, **some of them were attempting to recall what they had eaten five months previously. Since the California outbreaks were recently publicized, the probability that recall bias affected these results is substantial.**

Slide 19
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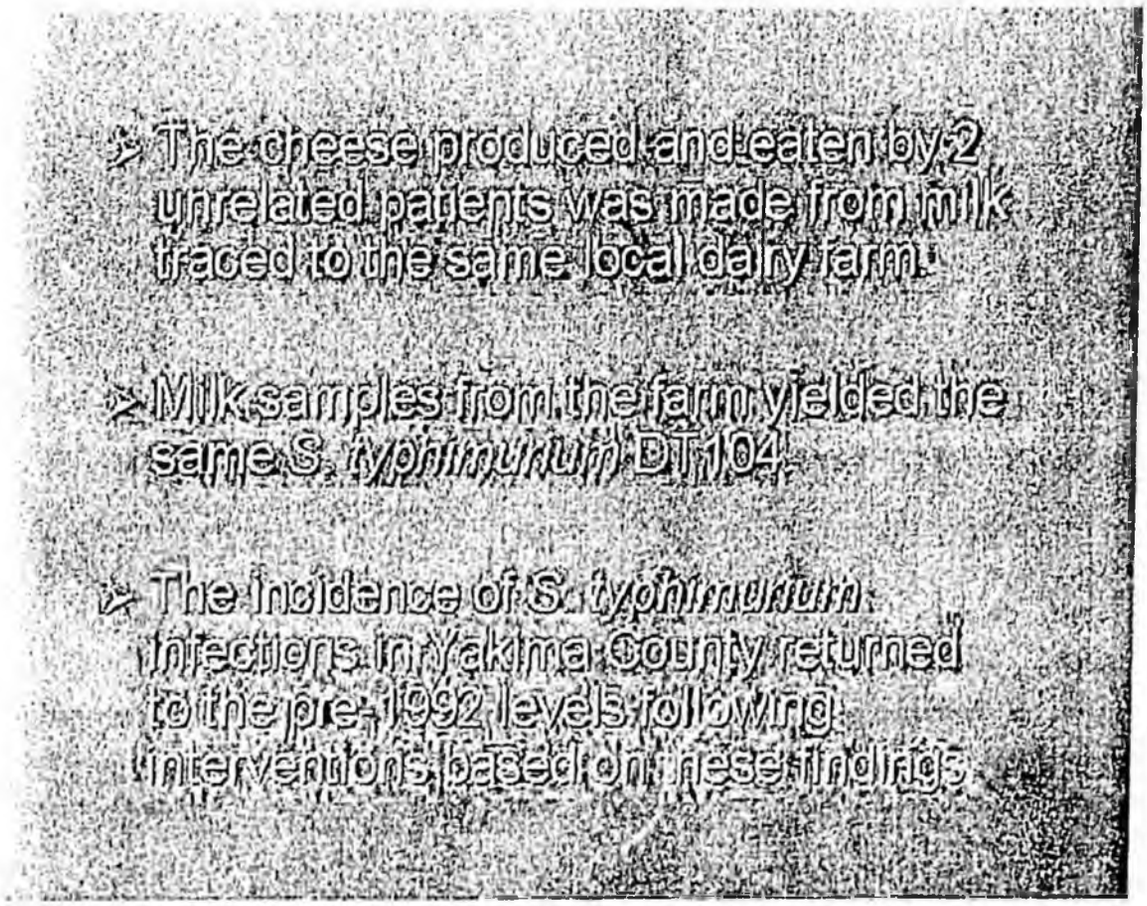


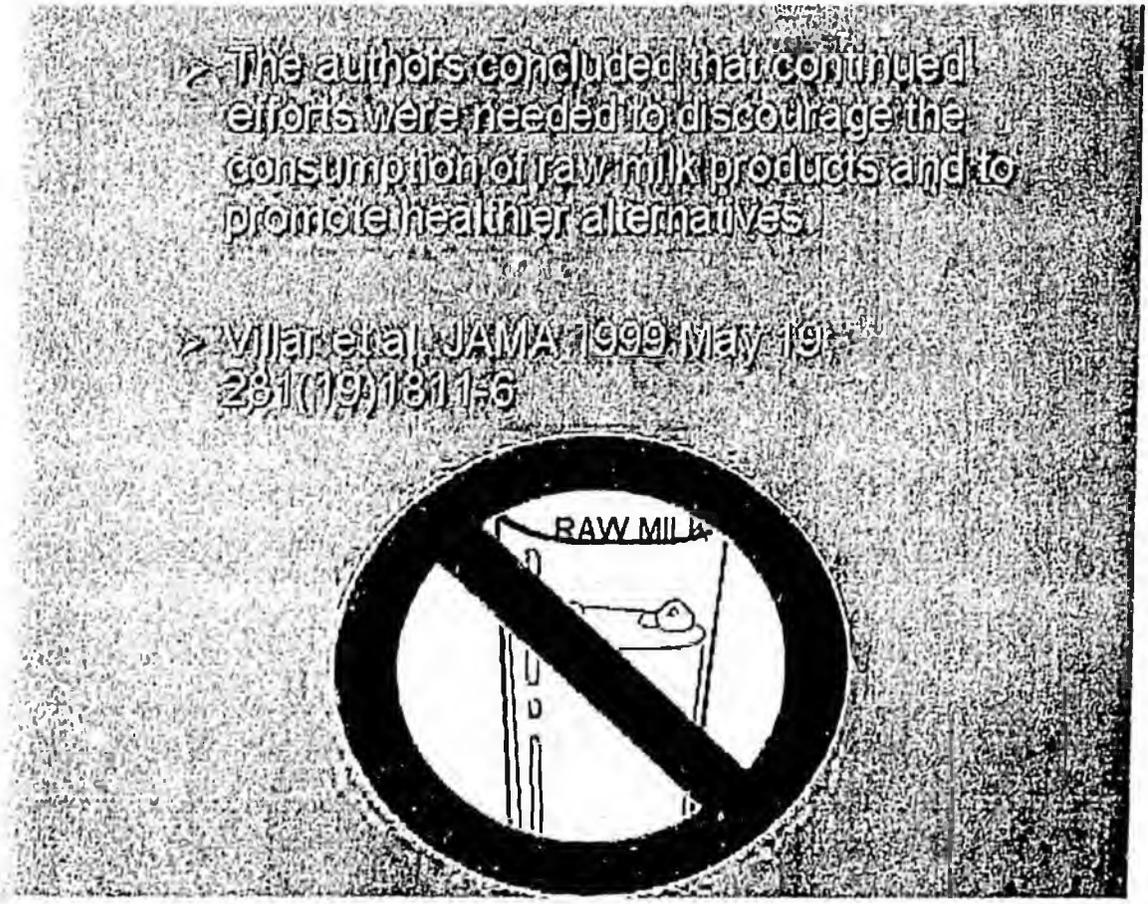
Contrary to the FDA's statement, samples from the farm did *not* yield *S. typhimurium* DT104.

"Cultures of milk from tanker trucks that collected unpasteurized milk from area dairies" yielded *S. thyphimurium.* By contrast, the authors reported that "cultures from 5 samples of the cheese made from unpasteurized milk, 2 samples of rennet, 2 samples of unpasteurized milk from the bulk tank of the implicated dairy, and rectal swabs obtained from 5 (3%) of 175 cows on the implicated dairy did not yield *Salmonella.*"

The cheeses eaten by the other 20 case patients were not traced to their sources.

The interventions focused on education about safe cheese-making practices that went beyond the use of pasteurized milk. **No evidence was ever produced tracing *Salmonella* to raw milk.**

Slide 20
http://www.cfsan.fda.gov/~ear/milksafe/milksa20.htm

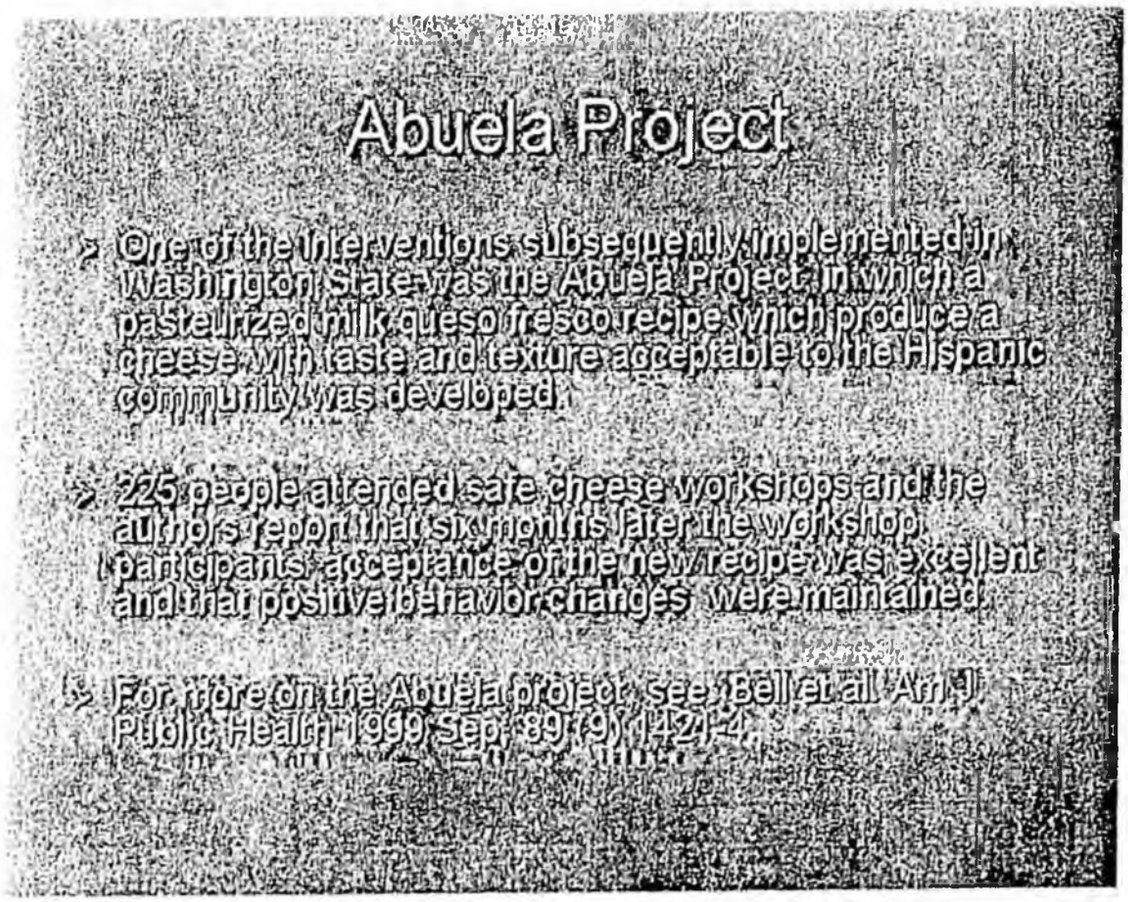


Because of the systematic bias against raw milk with which public health authorities approach the issue of food safety, no evidence showing contamination of raw milk with *Salmonella* was required to come to this conclusion.

Prior to the publication of this study, Canadian and European studies had linked *S. typhimurium* DT104 outbreaks to chicken, beef, pork, salami and sausages. These items are common enough in a typical kitchen that homemade cheese could easily become contaminated if it is not made carefully enough.

Health authorities never attempted to provide the residents of Yakima County with information about how to make raw milk cheese safely; they did, however, incorporate safe cheese-making education into a program encouraging the exclusive use of pasteurized milk.

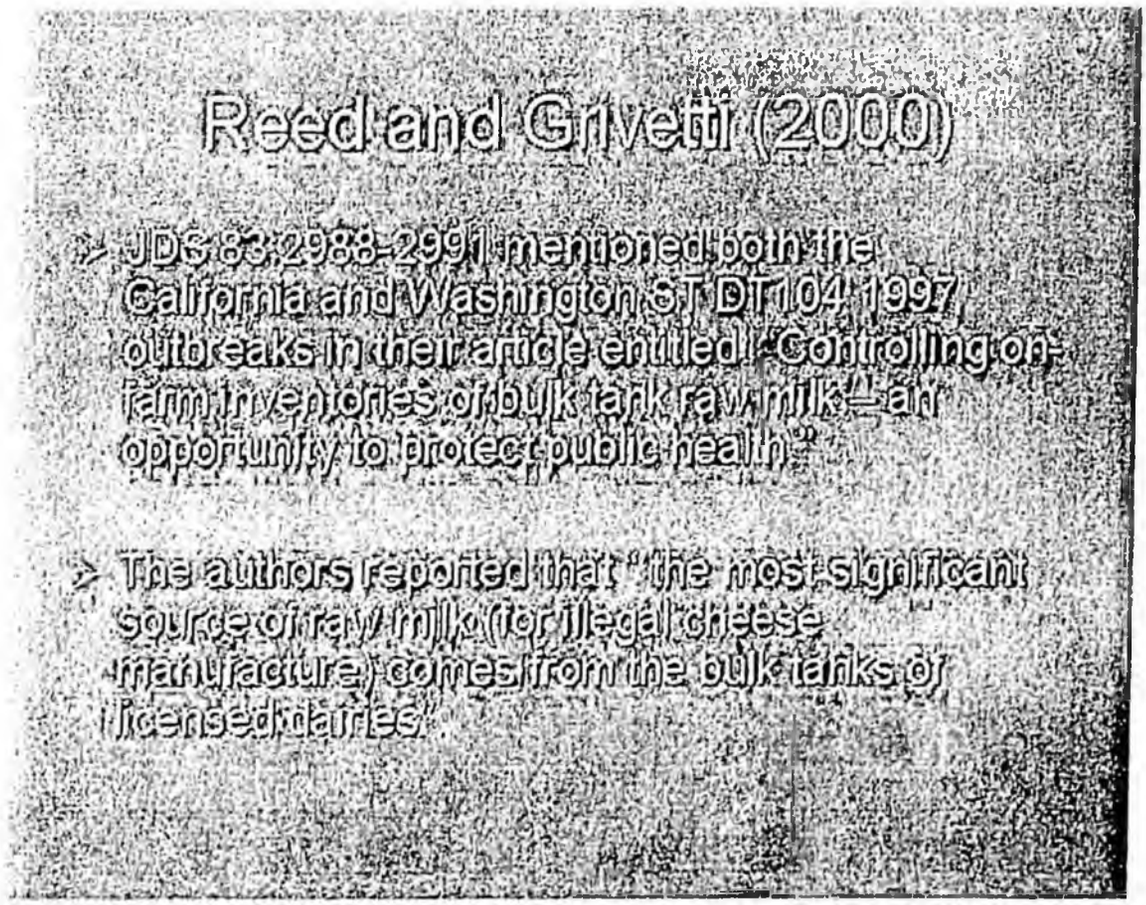
Slide 21
http://www.cfsan.fda.gov/~ear/milksafe/milksa21.htm



The program encouraged the exclusive use of pasteurized milk for the production of *queso fresco* but also educated community members about how to properly sanitize cheese-making implements.

Such a program would be expected to reduce the incidence of cheese-borne *Salmonella* whether it was present in the milk before leaving the farm or introduced into the milk during the cheese-making process.

Slide 22
http://www.cfsan.fda.gov/~ear/milksafe/milksa22.htm



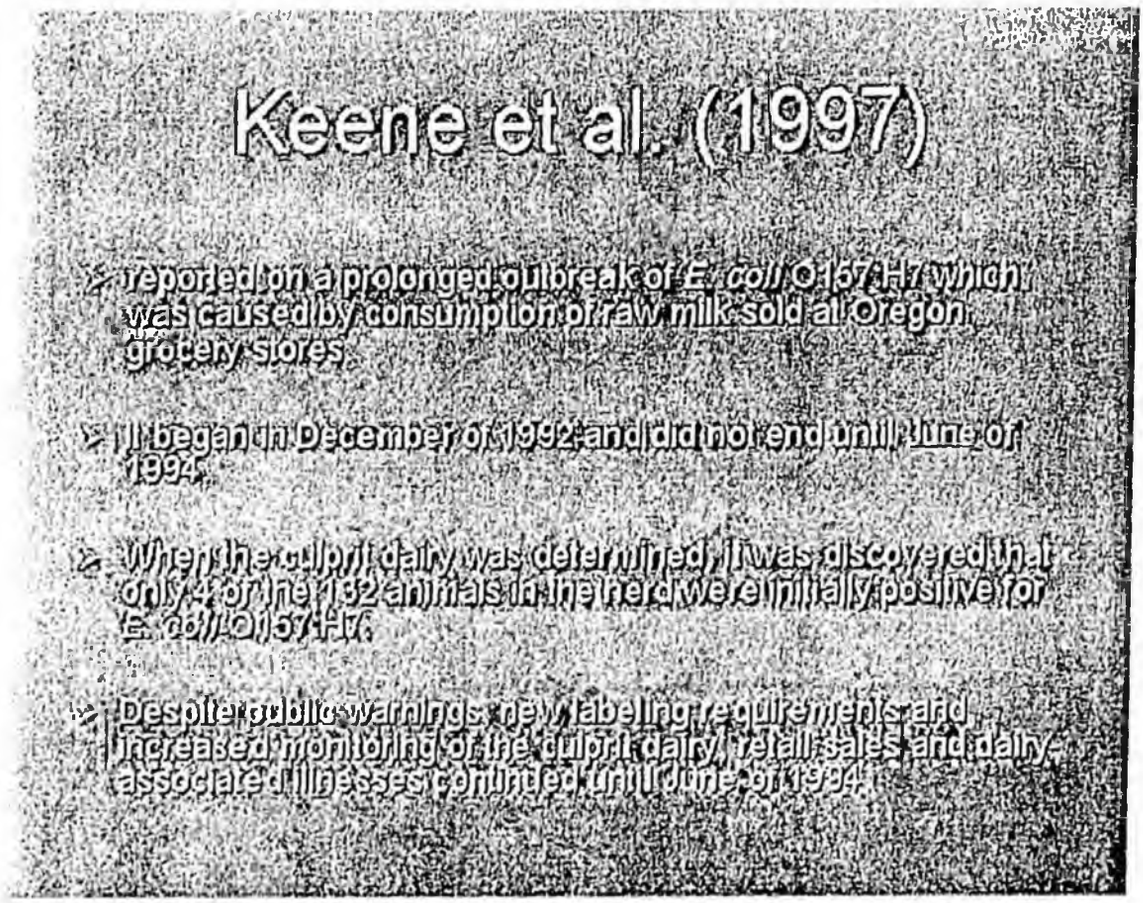
According to this article, a California Department of Food and Agriculture investigation of illegal cheese production found that cheese makers most commonly use the false claim that they need milk to feed to young livestock in order to convince large dairies to sell them unpasteurized milk under the table. They load up the purchased milk into pick-up trucks full of plastic 19-liter buckets. A farm that produces 20,000 to 40,000 liters of milk per day may sell about 200 liters to unlicensed cheese makers this way.

The farmer earns $12 per bucket, which is double the price he gets for selling the milk to a processing plant.

Raw milk illegally taken from a source that *is* intended for pasteurization *is* unsafe.

The open and legal sale of raw milk produced according to high standards is the safest solution to the public demand for nature's perfect food.

Slide 23 is a picture. Slide 24
http://www.cfsan.fda.gov/~ear/milksafe/milksa24.htm



There was no outbreak of *E. coli* O157:H7 in this community. The "outbreak" was "prolonged" precisely because it "never caused a noticeable increase in reported infections." In other words, it did not exist.

"Raw milk-associated cases" were defined as "those who reported drinking raw milk within the 10 days before symptom onset." The cases started in 1992 because this is when the researchers began looking for them, and ended in 1994 because this is when the state health authorities banned the sale of the local farm's raw milk.

Because of the "ongoing nature of the outbreak," the authorities decided that "it was not clear how to delimit a case-control study without significant bias." Since "a cohort study was also infeasible," they "elected to notify the public immediately."

No *E. coli* O157:H7 was ever found in the dairy's milk.

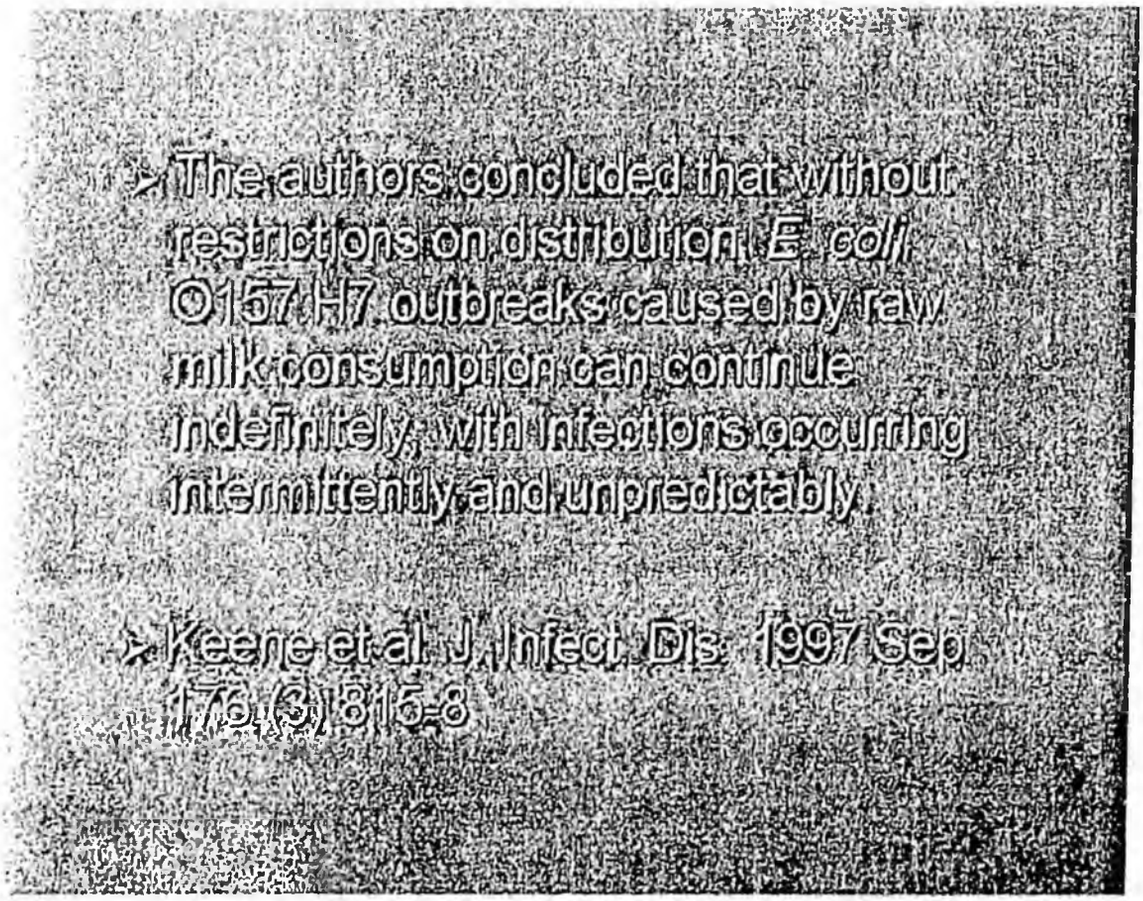
Response to Slide 24 Continued

Nevertheless, an injunction was issued in June of 1994 banning sales of the milk. The farmer continued to sell the uncontaminated milk until October of 1995 and was fined and jailed for contempt of court.

Although the incidence of *E. coli* O157:H7 never changed, no cases associated with the consumption of milk from this dairy have been reported since the milk was banned in June of 1994.

The authors correctly concluded from this that "the only effective way to stop raw milk-associated disease is to stop people from drinking raw milk."

Slide 25
http://www.cfsan.fda.gov/~ear/milksafe/milksa25.htm



The authors lamented that it is "easier said than done" to "stop people from drinking raw milk" and that sales of the milk in question had "continued until the dairy was forced out of the retail business."

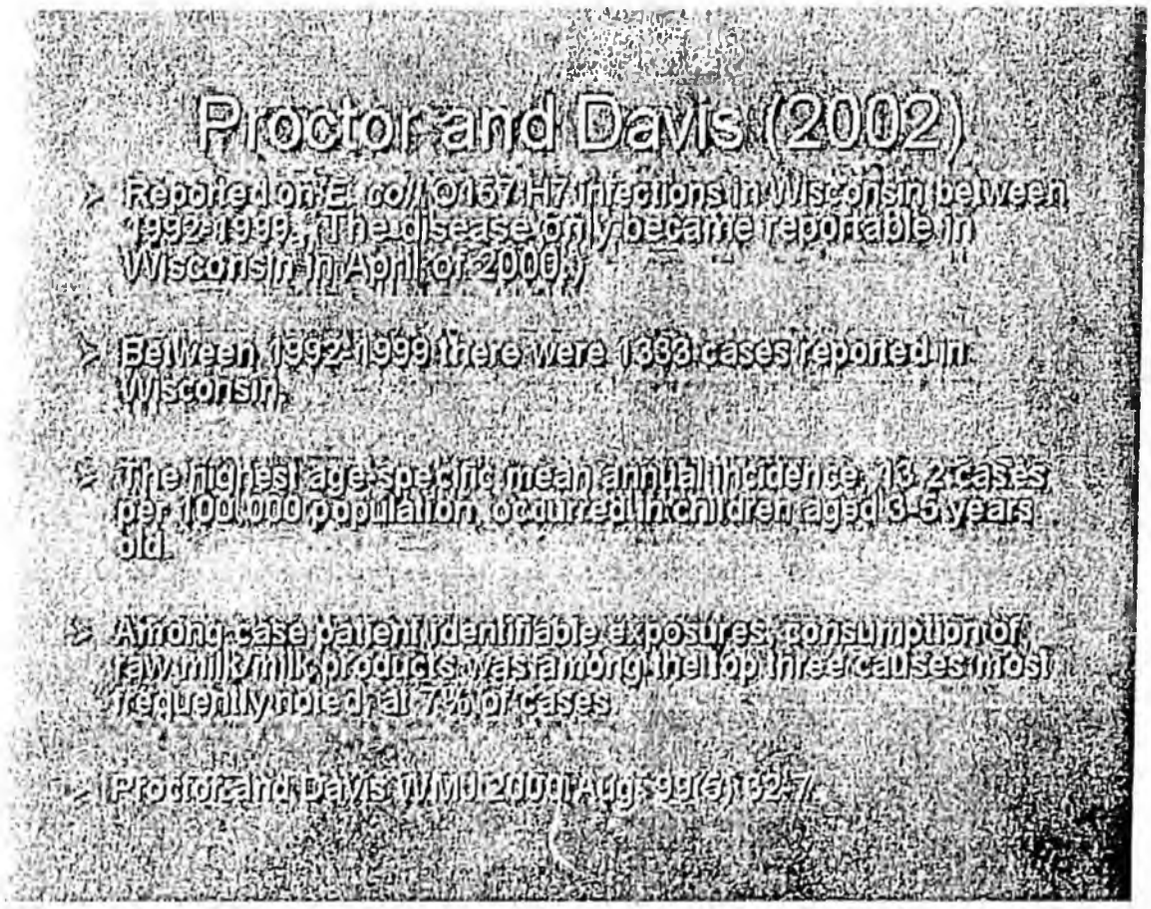
Legislation to outlaw the retail sale of raw milk in Oregon had recently died in committee.

The authors concluded that "short of an outright ban on sales," the next best solution was "continuing consumer education and increasing financial risks for suppliers."

The FDA estimates that between 1996 and 2005, fresh produce was responsible for over 8,000 *E. coli* O157:H7 infections. Eggs were responsible for over 6,500; processed foods for over 3,000; and sprouts for over 1,500.

No legislation has yet been drafted to outlaw the retail sales of fresh produce, eggs, processed foods, or sprouts.

Slide 26
http://www.cfsan.fda.gov/~ear/milksafe/milksa26.htm



This study did not identify the causes of any of the 1333 infections.

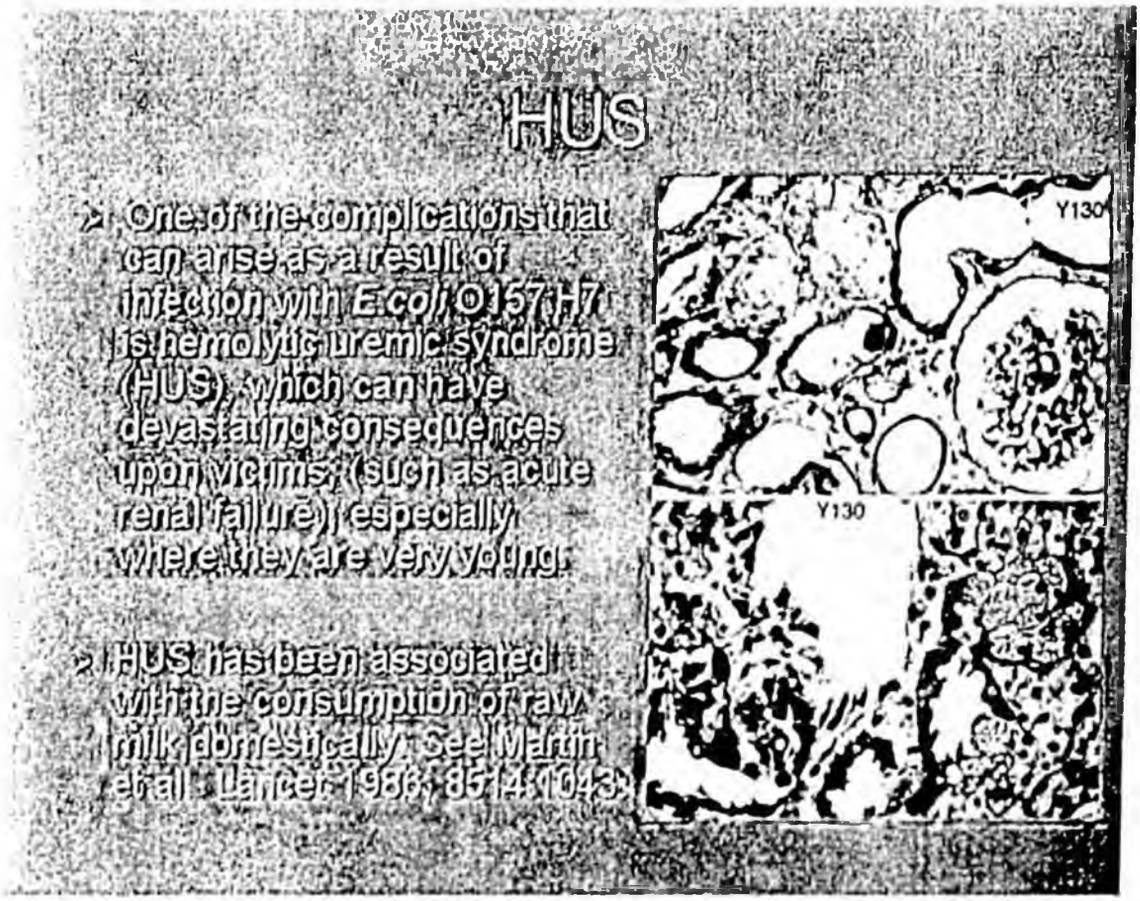
The authors simply compiled the cases that were reported during this time period. They identified risk factor information additional to that which was originally reported by reviewing case follow-up forms. They did not provide any information about the content of these forms except that they ascertained whether the patients had drunk unpasteurized milk or had contact with other infected patients in a daycare setting.

The authors identified consumption of unpasteurized milk as the "most probable risk exposure" in 7.0% of cases but did not describe any scientific methodology that they used to determine which risk exposure was "most probable."

Other "most probable risk exposures" included farm-related exposures (13.4%), recreational water exposures (8.1%) and person-to-person exposures (5.1%).

No evidence was provided or cited indicating that any unpasteurized dairy was contaminated with *E. coli*.

Slide 27
http://www.cfsan.fda.gov/~ear/milksafe/milksa27.htm

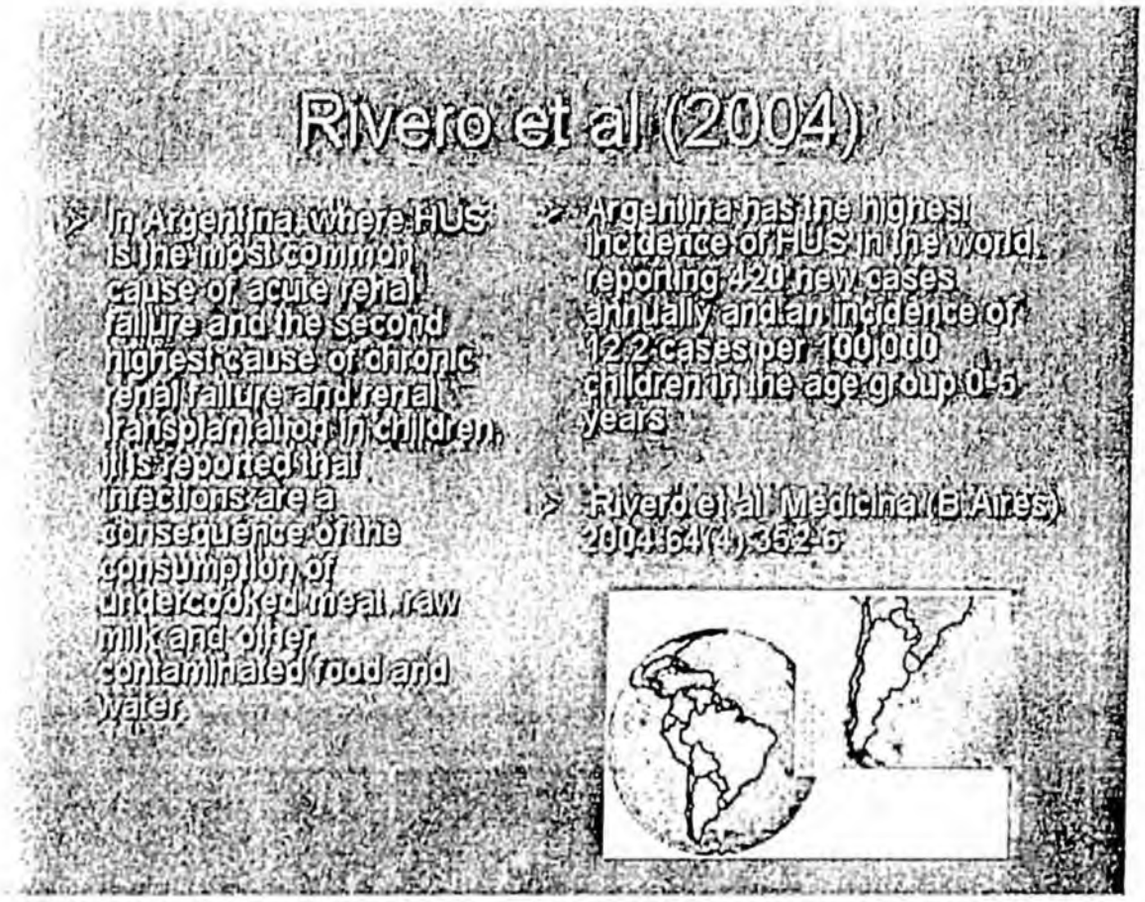


This reference is a report of two cases of HUS that occurred in children who had drunk raw milk. One child tested positive for *E. coli* O157:H7 but the other did not.

Manure from cattle on the dairy farm tested positive for *E. coli* O157:H7 – as does the manure from nearly 30% of feedlot cattle in the United States -- but the authors did not report testing any of the milk.

There was no evidence that raw milk was contaminated with *E. coli*, nor any evidence that this organism was the cause of the second case of HUS.

Slide 28
http://www.cfsan.fda.gov/~ear/milksafe/milks28.htm



The authors of this review stated that human infections with the "verocytotoxigenic" subgroup of *Escherichia coli* O157:H7 (named for the toxins it makes) are frequently due to unpasteurized milk and inadequately cooked meat, direct contact with animals or their feces, or the consumption of contaminated water, fruits and vegetables.

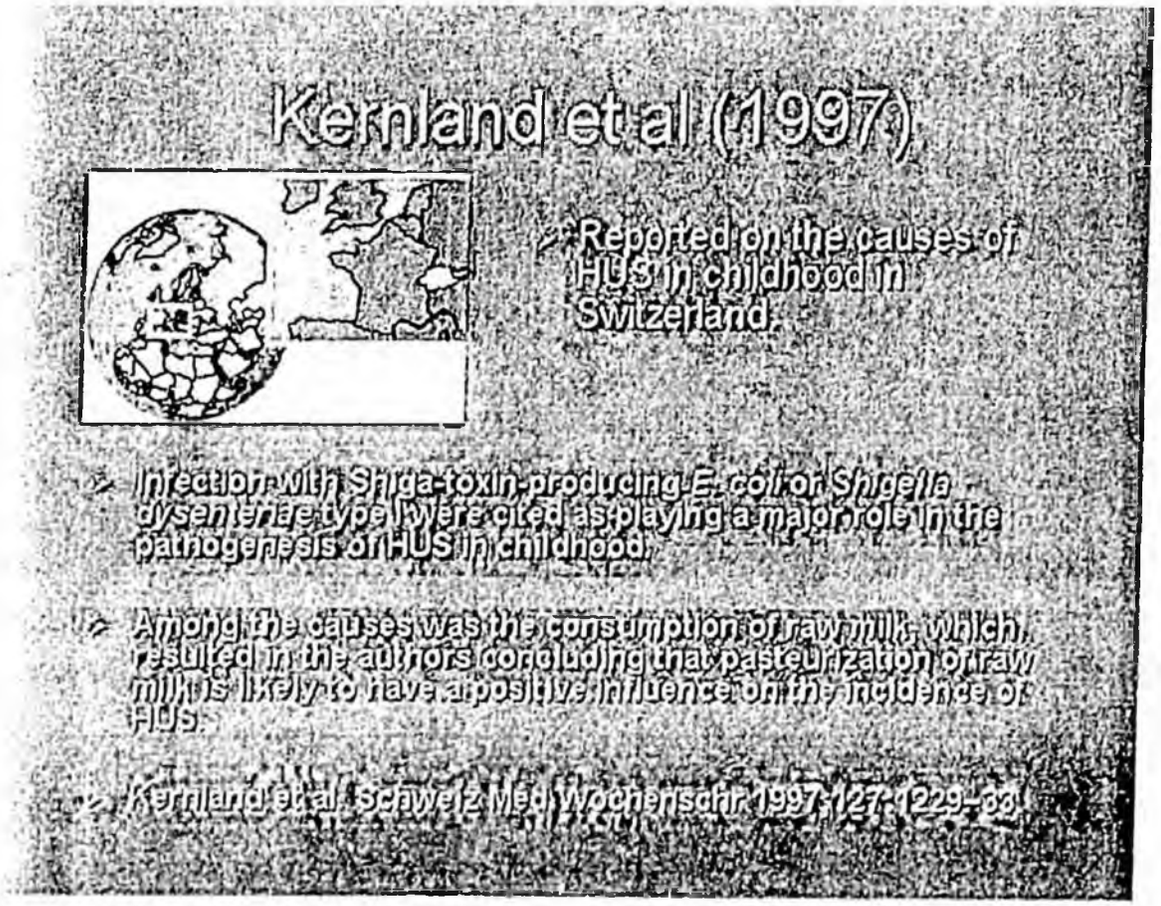
They did not present new data, but cited two references for these facts: one study conducted in England and one conducted in Scotland. Both found environmental factors such as direct and indirect contact with farm animals to be the primary means of infection.

The authors of one of them concluded in their abstract, "The most important findings were the high proportion of cases who had been exposed to environmental factors such as farm animals and/or their by-products; or who had participated in gardening or garden-play; or who had suspected or confirmed household water supply problems, prior to the onset of illness."

There is no evidence that raw milk is responsible for Argentina's high incidence of HUS.

Slide 29

http://www.cfsan.fda.gov/~ear/milksafe/milksa29.htm



The authors sought to identify statistical risk factors of HUS, not causes.

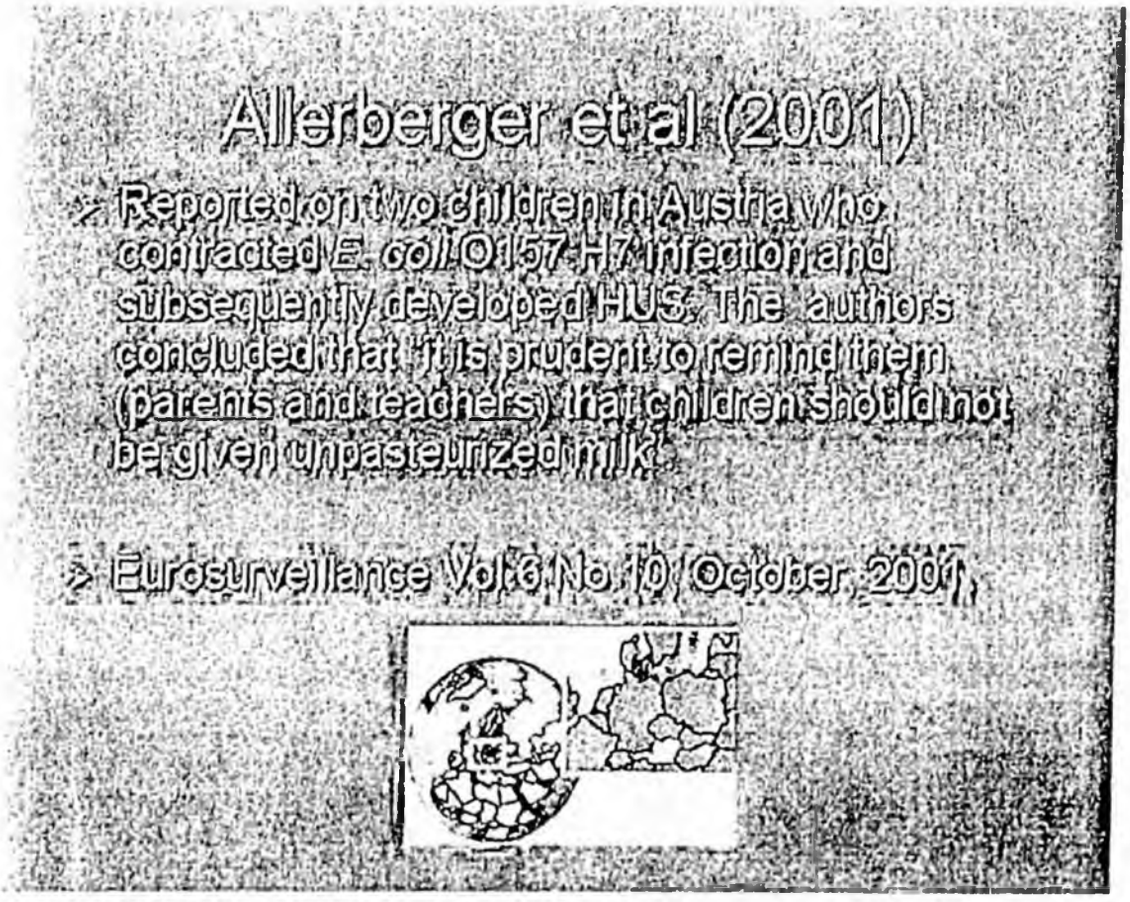
They compared 27 children with HUS to 27 children without HUS in a case-control study. Seven children with HUS had parents who were farmers, five lived in rural cattle-breeding areas, and five had visited a stable or come into contact with cow manure. By contrast, only two children without HUS had parents who were farmers, and only one lived in a rural cattle-breeding area or had visited a stable and come into contact with manure.

Only one out of 27 children with HUS had drunk raw milk. None of the 27 children without HUS had drunk raw milk. The authors could not perform any statistical analysis indicating that raw milk was a risk factor. Instead, they grouped it in with the other farm-related exposures and concluded that this group of exposures as a whole was associated with HUS.

There was no evidence that raw milk caused the *E. coli* infection in the single person who drank it.

Slide 30

http://www.cfsan.fda.gov/~ear/milksafe/milksa30.htm



Only one of these children developed HUS. Neither case was conclusively linked to raw milk; **in the HUS case, raw milk was explicitly ruled out.**

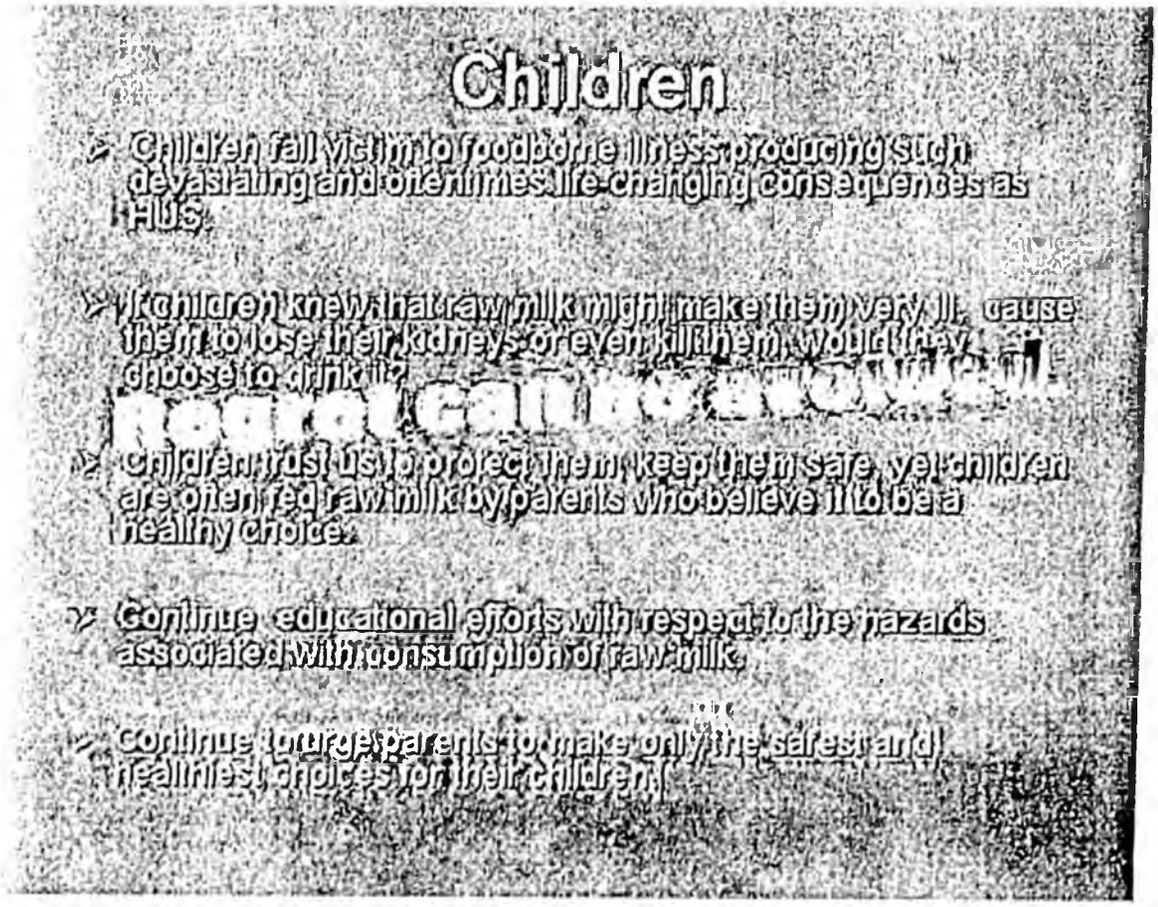
In the first case, the boy was visiting a rural farm on a school trip where he had direct contact with farm animals and their manure. He did not develop HUS. The authors of the report concluded that it was more likely that he contracted *E. coli* from drinking raw milk than from contact with manure. **Nevertheless, they only found *E. coli* present in manure and none of the milk samples they tested were contaminated. One teacher and 13 other school children also drank the milk and did not get sick.**

Of the second case, the authors concluded: "Although the child with HUS was given unpasteurized cows' milk regularly by his parents, his severe illness . . . was not related to consumption of raw milk."

Both boys fully recovered.

Slide 31

http://www.cfsan.fda.gov/~ear/milksafe/milksa31.htm



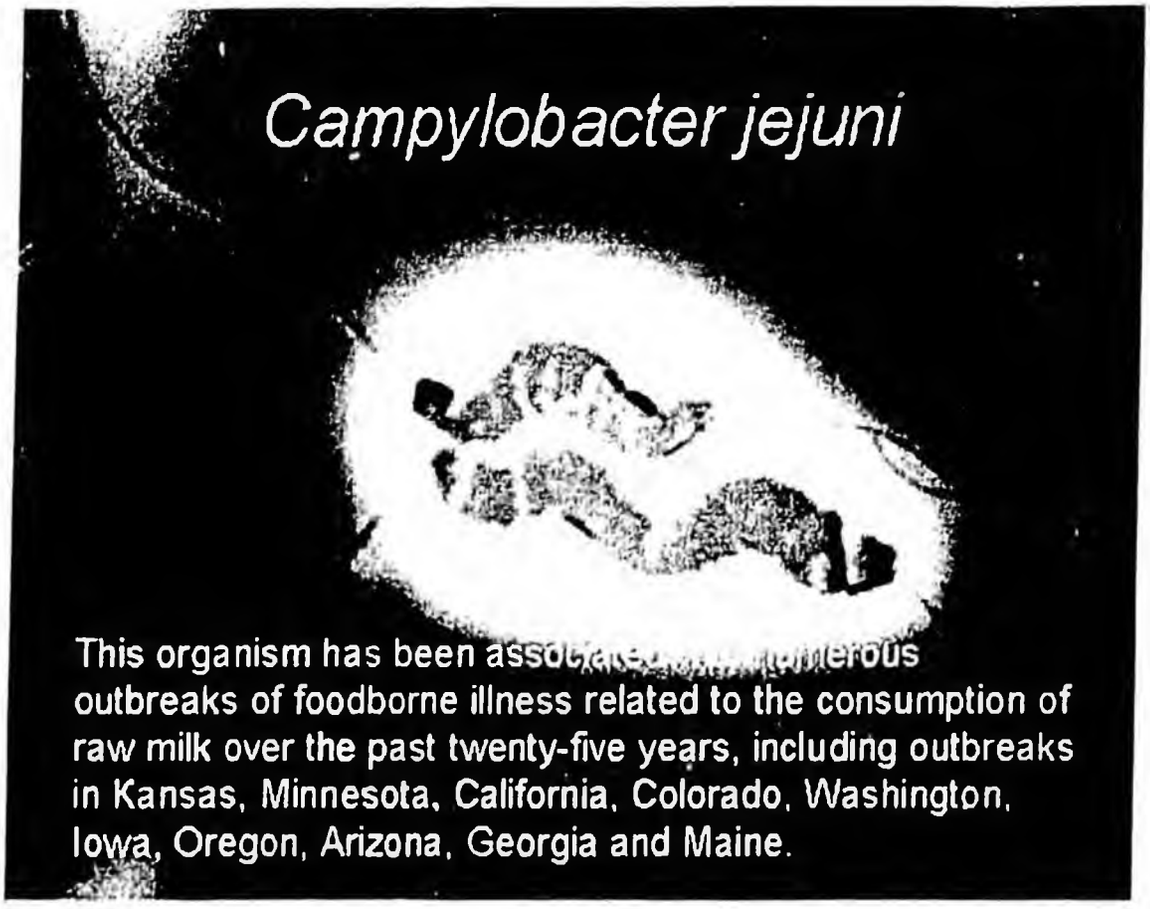
The conclusion of the previous case report bears repeating: "Although the child with HUS was given unpasteurized cows' milk regularly by his parents, his severe illness . . . was not related to consumption of raw milk."

Education is only valuable insofar as it is founded upon truth.

The use of properly produced raw milk *is* among the safest and healthiest choices parents can make for their children.

Slide 32

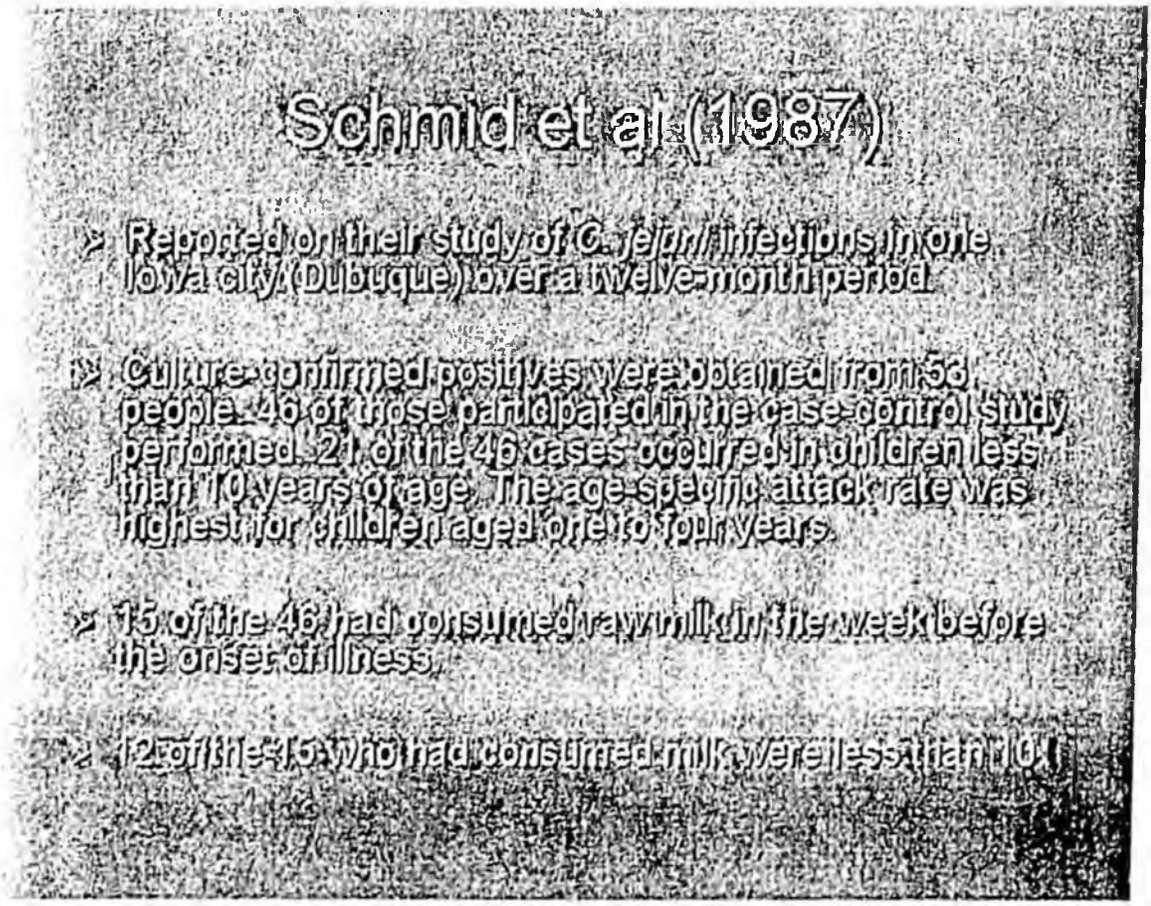
http://www.cfsan.fda.gov/~ear/milksafe/milksa31.htm



Between 1990 and 2005, this organism has also been associated with numerous outbreaks of foodborne illness reported to the CDC as relating to the consumption of the following foods: beef, pork, quail, grilled chicken, baked chicken, barbecued chicken, chicken liver, oysters, chicken and beef fajita, potato salad, Caesar salad, tuna salad, green salad, taco salad, fruit salad, pasta salad, green peas, baked beans, lettuce, melon, strawberries **and pasteurized milk.**

Slide 33

http://www.cfsan.fda.gov/~ear/milksafe/milksa33.htm



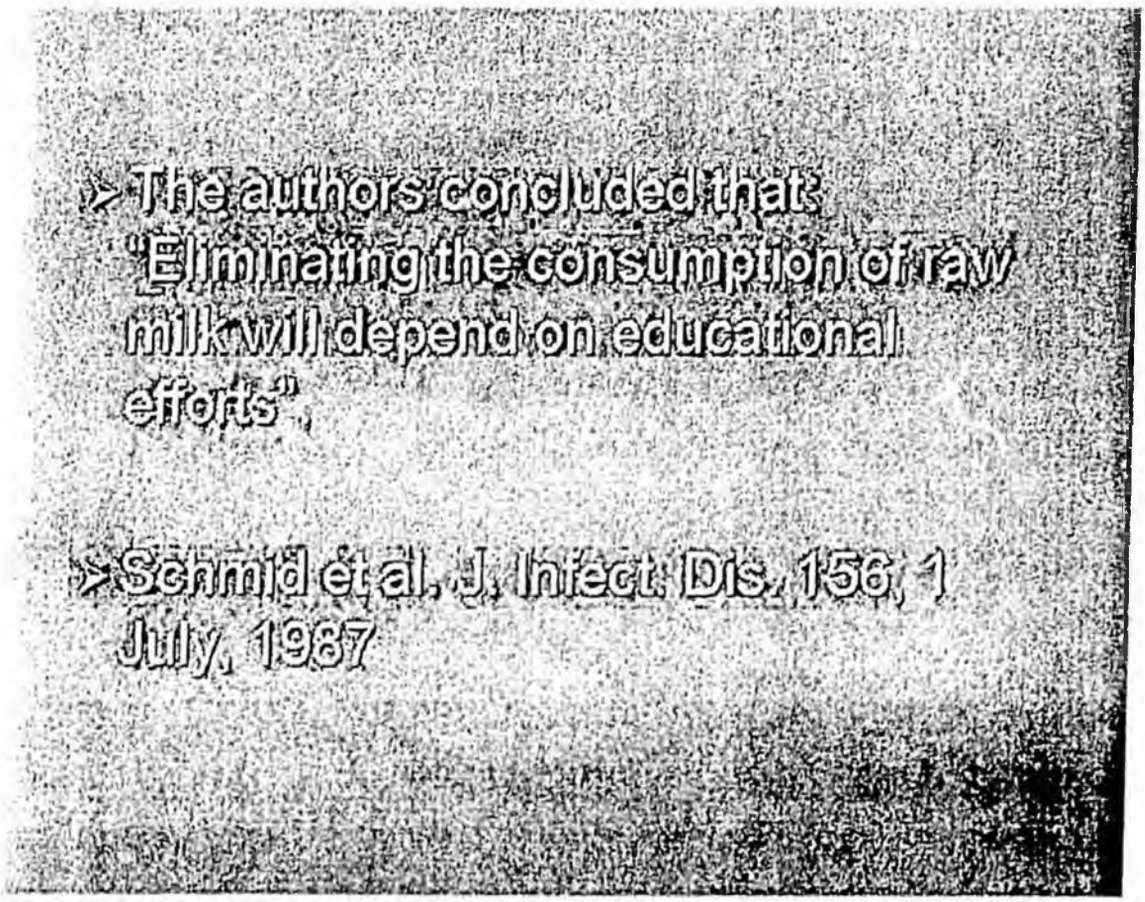
The statistical association of illness with the consumption of raw milk was compelling: 32.6% of infected patients had drunk raw milk and 10.9% of matched control subjects had drunk raw milk. This association, however, does not prove causation. It could reflect the consumption of contaminated milk or it could reflect a common exposure to another cause.

Six of the 15 patients who had drunk raw milk lived in the city and drank raw milk during visits to rural farms. The remaining nine lived in rural environments – the investigators did not report whether they visited or lived on farms. One patient who drank raw milk was staying overnight at a farm where two out of eight asymptomatic family members tested positive for the organism.

The authors of the report noted that "owning farm animals of various types" is a risk factor for *C. jejuni* infection.

Multiple milk samples from seven patients' households were tested for *C. jejuni*. All of them tested negative. By contrast, 360 samples of locally sold chicken tested positive.

Slide 34
http://www.cfsan.fda.gov/~ear/milksafe/milksa34.htm



They stated that this was because "the ready availability of raw milk" persisted despite the fact that "the commercial and private sale of raw milk is already illegal in Iowa." Clearly, the demand for raw milk – because of its superior taste and health value – is not going away. The government cannot do anything to ensure the safety of raw milk if it is illegal. Only an open system of private or governmental oversight and certification will ensure that consumers have access to safely produced, healthy raw milk.

These authors did not explain why such a tenuous association with raw milk that could not be confirmed by a single contaminated sample should be considered grounds for eliminating its consumption.

Despite hundreds of positive samples, they offered no suggestions about how to eliminate the consumption of chicken.

And despite a 65% reduced risk of infection among those who always washed their hands before eating, they made no remarks about the necessity of educational efforts addressing personal hygiene.

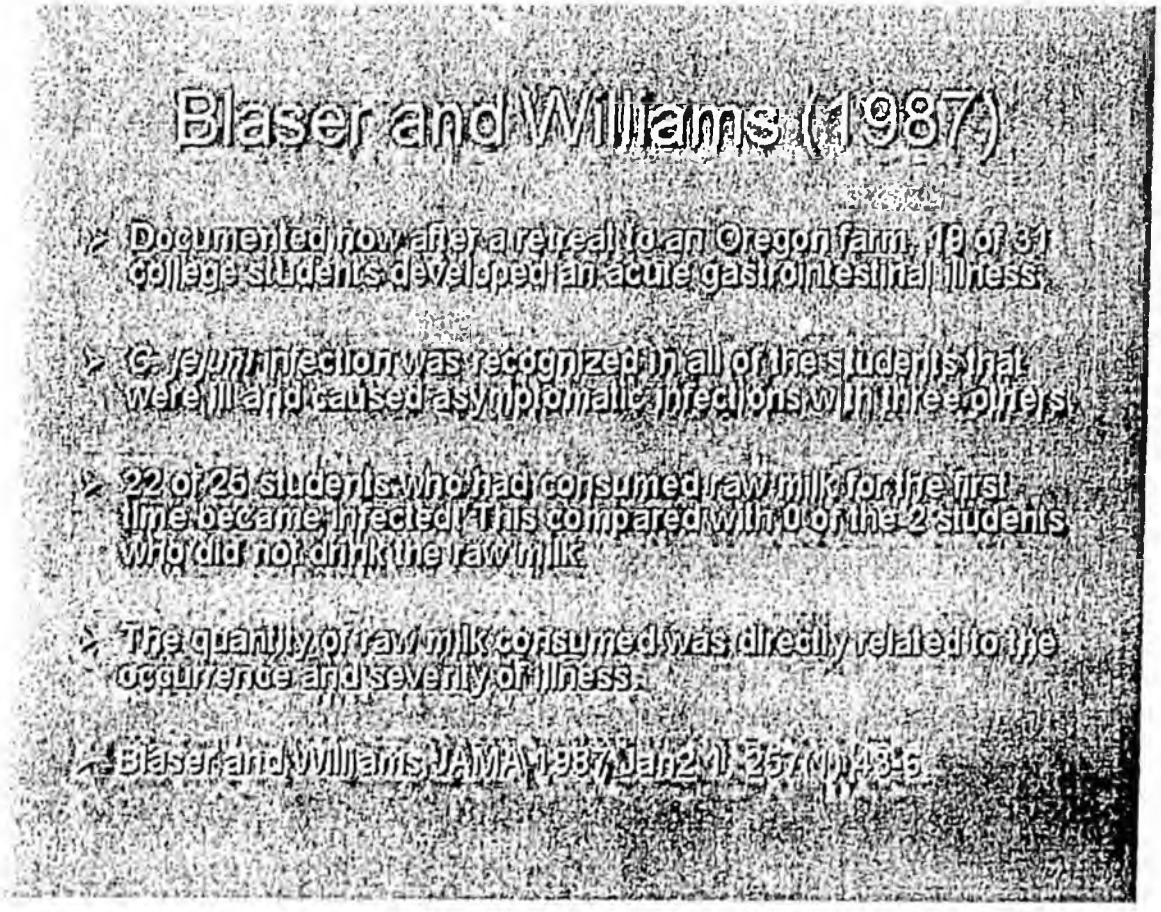
Slide 35

http://www.cfsan.fda.gov/~ear/milksafe/milksa35.htm

Nor is it only those who drink raw milk that may fall victim to the disease. In the preceding outbreak, almost 70% of infected patients had not drunk raw milk. **Between 1990 and 2005, 22 other foods were reported to the CDC as associated with a *C. jejuni* outbreak, including meats, salads, fruit, and pasteurized milk.**

Slide 36

http://www.cfsan.fda.gov/~ear/milksafe/milksa36.htm



The presence of *C. jejuni* was demonstrated in 7 out of the 15 symptomatic students from whom fecal samples were obtained.

The incidence of illness increased between consumption of one and four glasses of milk from 30% to 100%, but those who drank more than four glasses of milk had an even lower incidence (67%) than those who drank two glasses of milk (80%).

The owner of the farm tested positive for *C. jejuni* and had prepared breakfast for the students. Four weeks later, a sample of cow manure tested positive for *C. jejuni*, but the investigators made no attempt to test any of the milk for the organism, claiming that no reliable methods were available at the time.

Although the *C. jejuni* was not conclusively linked to the milk, the milk was taken from a bulk tank intended for pasteurization, so may not have been subject to as strict standards of quality as milk intended to be drunk unpasteurized would be. The farmer who tested positive could also have contaminated any of the food consumed by the students including the milk, **in which case pasteurization would not have prevented the outbreak.**

Response to Slide 36 Continued

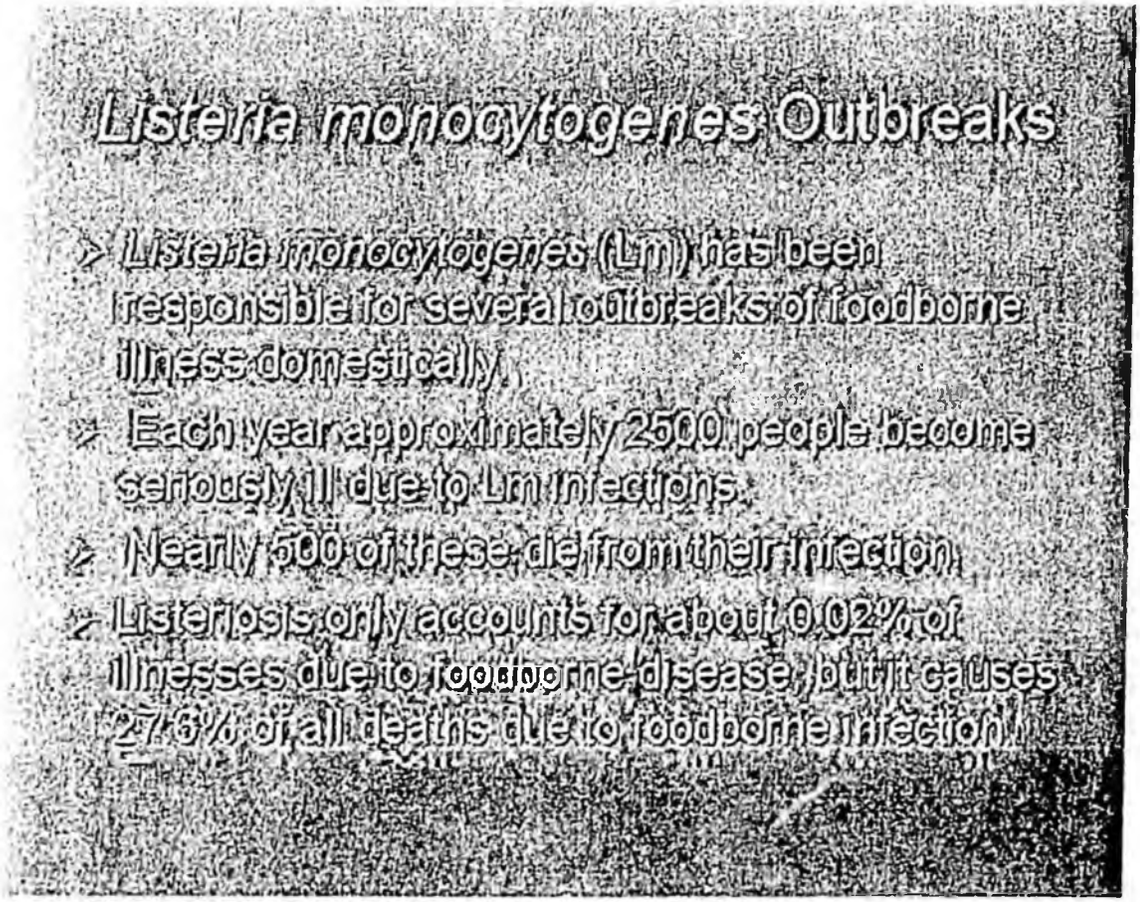
Six farm workers and four students who drank the raw milk were chronic raw milk drinkers. Despite drinking the implicated milk, **none of the ten chronic raw milk drinkers got sick.**

All ten chronic raw milk drinkers had an acute-phase antibody reaction to *C. jejuni* comparable to those who became ill, but none of them yielded fecal samples positive for the organism or developed symptoms. The authors suggested that this was because they **had developed immunity to *C. jejuni* through previous consumption of raw milk,** but admitted that they had no evidence showing that the presence of antibodies was due to past rather than current exposure. Alternatively, there may be nutritive factors in raw milk that confer a general robustness of immunity on those who consume it regularly.

Regardless of the mechanism, **the study clearly demonstrates that the regular consumption of raw milk offers powerful protection against foodborne illness.**

Slide 37 is a picture. Slide 38.

http://www.cfsan.fda.gov/~ear/milksafe/milksa38.htm

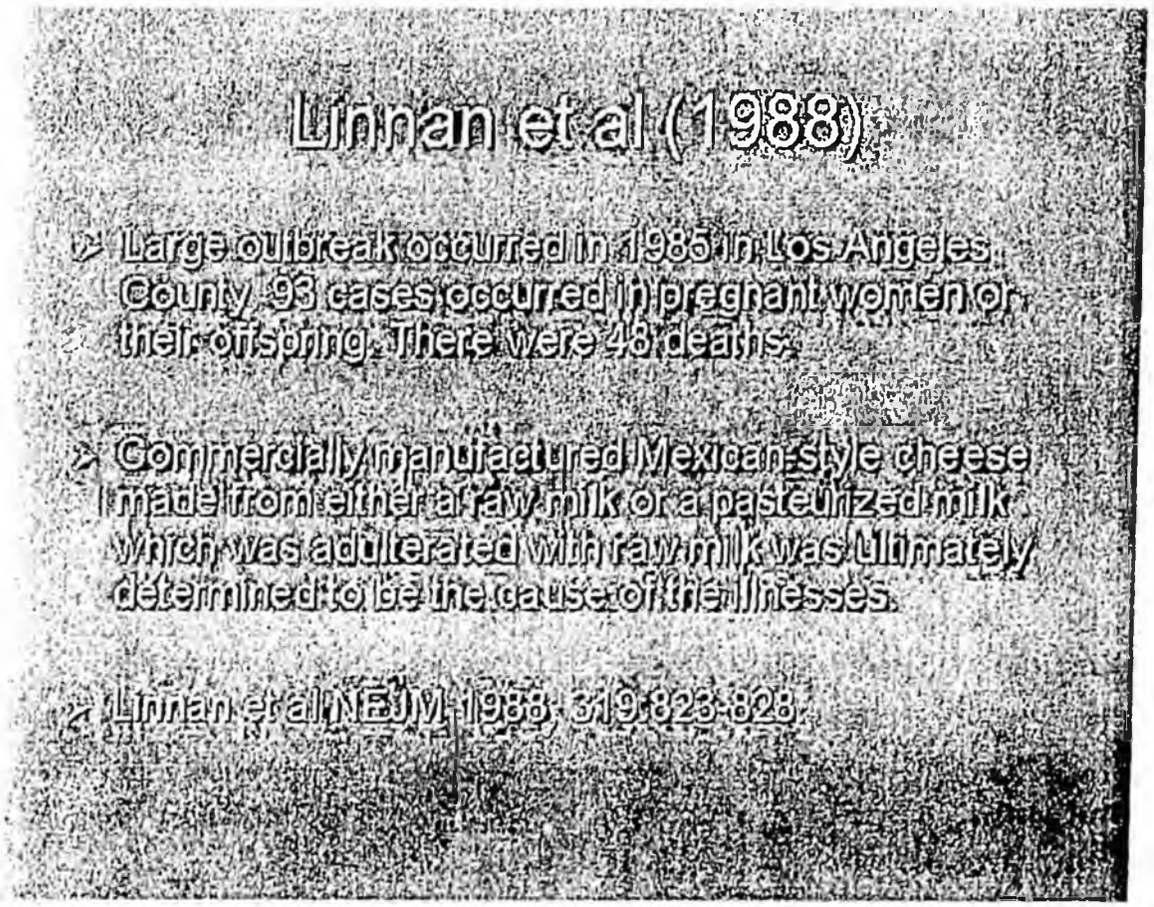


Listeriosis is indeed a serious disease. As we will see shortly, many commonly consumed foods carry a far greater risk of causing the disease than raw milk does.

Pasteurized milk can carry *Listeria* as well.

Slide 39

http://www.cfsan.fda.gov/~ear/milksafe/milksa39.htm



There was never any evidence that the contamination of this cheese – which was sold as a pasteurized product – was related to contaminated raw milk.

The initial investigation found that, compared to uninfected controls, infected patients were 5.5 times more likely to eat Mexican-style cheese, 4.3 times more likely to have sexual intercourse in the preceding month, and 4.1 times as likely to consume a root vegetable called jicama.

A secondary investigation found that the association with cheese was due specifically to the use of a cheese produced by Jalisco Mexican Products. The investigators did not pursue the associations with sexual intercourse or jicama any further.

They found the matching strain of *Listeria* in multiple unopened packages of the cheese on June 12, 1985 and initiated a recall of the product the following day. **Despite the recall, the outbreak continued producing new cases at full force through the end of July.**

Response to Slide 39 Continued

Investigation of the factory showed that the pasteurizer was working properly. Tests of the cheese for activity of the enzyme alkaline phosphatase (ALP), however, showed excessive activity in 9 out of 80 samples of cheese. Activity of this enzyme was taken to indicate inadequate pasteurization.

The authors provided no data showing a relationship between ALP levels and contamination with live *Listeria.* **Thus, there was no evidence that adequate pasteurization would have prevented the outbreak.**

Moreover, some bacteria produce ALP that cannot be differentiated from ALP indigenous to milk. Murthy and Cox (1988) showed that Mexican-style soft cheeses contain both heat-stable and heat-labile forms of microbial ALP. Geneix et al. (2007) published a new detection method this year to correct this problem. Thus, this test when performed in 1985 was not a valid means for demonstrating inadequate pasteurization in this type of cheese.

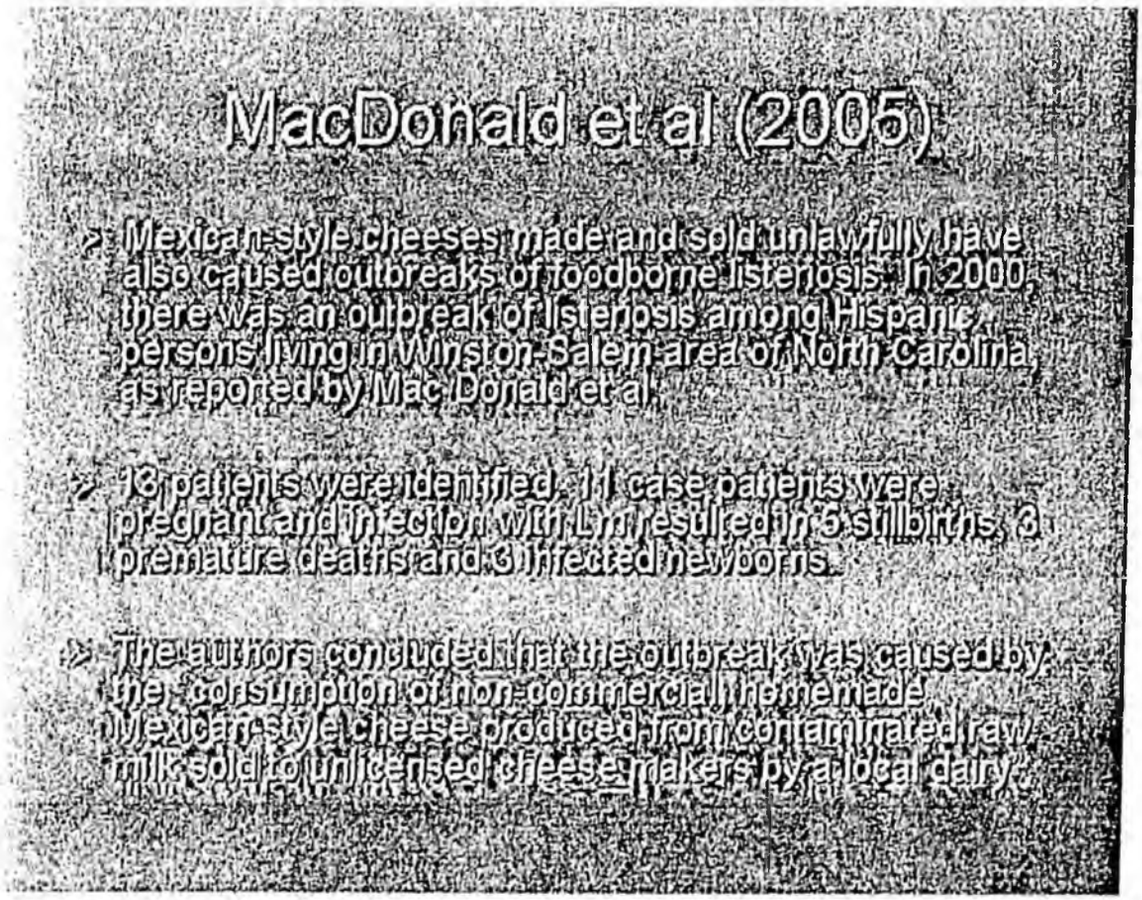
Of 27 dairy farms that supplied raw milk to the cheese plant, there were no cases of listeriosis in any of the herds and **all raw milk samples tested negative for the organism.**

The milk or cheese was clearly contaminated at the cheese manufacturing plant, whether before pasteurization, after pasteurization, or both.

Jalisco sued Alta Dena dairy, one of its suppliers, for a portion of the estimated $100 million in damage claims filed by victims of the listeriosis epidemic. **In 1989, however, a jury absolved Alta Dena of all responsibility for the epidemic because there was never any evidence that its raw milk was contaminated.**

According to the paper cited by the FDA, this outbreak of *Listeria* was the third one traced to a specific food product. The first occurred in 1981 and was traced to coleslaw. The second occurred in 1983 and was traced to pasteurized milk – 49 patients became ill and 14 died.

Slide 40
http://www.cfsan.fda.gov/~ear/milksafe/milksa40.htm



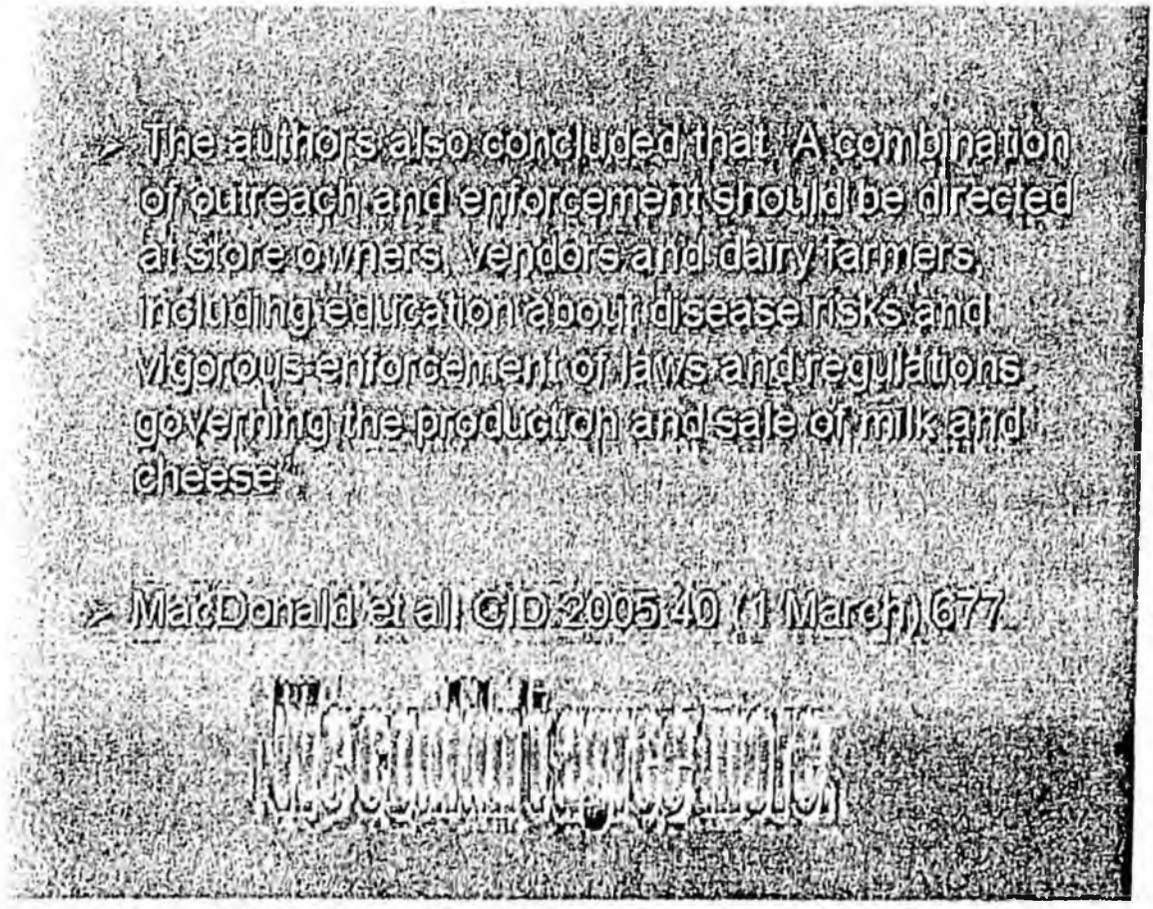
The results of the case-control study may have been biased. The authors reported: "During the study, rumors spread that the suspected vehicle of infection was homemade Mexican-style cheese."

Case patients were almost five times as likely as controls to have eaten hot dogs. According to a 2003 risk assessment jointly published by the FDA, USDA and CDC, **non-reheated hot dogs are over 380 times as likely as fresh, soft cheese to cause listeriosis.** No hot dogs were tested for the presence of *Listeria.*

Listeria was present in the bulk tank raw milk of a manufacturing-grade dairy equipped only to produce processed dairy products such as cheese and butter. **Bulk tank raw milk from dairies equipped to sell milk as a beverage did not contain the organism.**

The milk from the manufacturing-grade dairy was no longer contaminated once the dairy implemented "revised milking procedures that focused on proper preparation of cow teats and thorough cleaning of equipment." **No pasteurization was necessary to prevent contamination with *Listeria.***

Slide 41
http://www.cfsan.fda.gov/~ear/milksafe/milksa41.htm



The preceding sentence reads, "For Hispanic women, we recommend targeted education and dietary counseling about the hazards of eating fresh cheese, undercooked hot dogs, deli meats, and other ready-to-eat meat products implicated as vehicles for listeriosis during pregnancy."

In September, 2003, the FDA, USDA and CDC jointly released a report comparing the risk of listeriosis carried by various foods. The report estimated how many people were likely to catch listeriosis from a given food per year on an absolute basis and on a per serving basis.

On a per-serving basis, this report estimated that deli meats are 10.8 times more dangerous than raw milk and that non-reheated hot dogs are 9.2 times more dangerous than raw milk. Since deli meats are so commonly consumed, on an absolute basis they carry 515 times as great a risk as raw milk.

The FDA has yet to inform us that "hot dogs and deli meats are ***inherently*** dangerous."

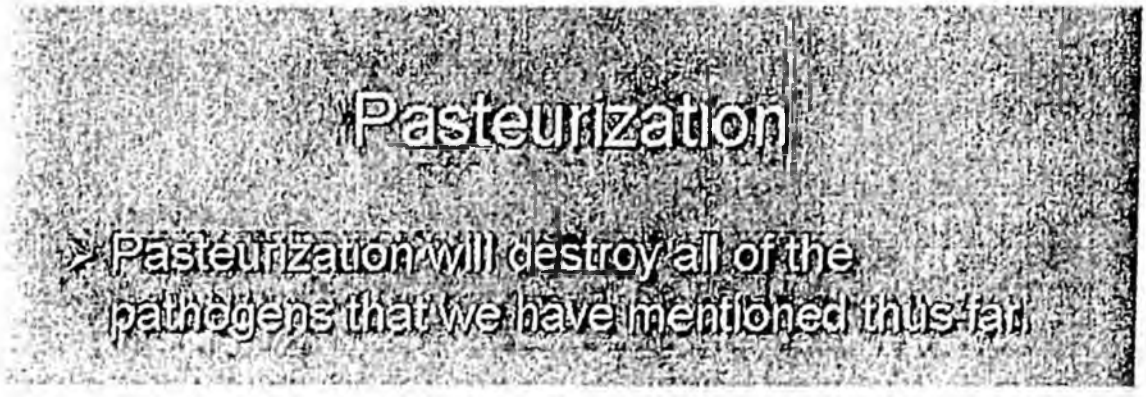
Conclusions – Biased Studies Fail to Indict Raw Milk

As can be seen in the table below, *all* of the 15 reports associating outbreaks of foodborne illness with raw milk that the FDA cites are seriously flawed. **Not one of the studies showed that pasteurization would have prevented the outbreak.**

Either No Valid Positive Milk Sample or No Valid Statistical Association	14/15 (93%)
No Valid Positive Milk Sample	12/15 (80%)
No Positive Milk Samples at All	11/15 (73%)
Outbreak Did Not Match Milk Strain	1/15 (7%)
No Valid Statistical Association with Raw Milk:	10/15 (67%)
No Statistical Association with Raw Milk at All:	7/15 (47%)
Invalid Case-Control Comparison:	1/15 (7%)
Case-Control Study Tainted by Publicity:	2/15 (13%)
Neither Association nor Milk Sample	8/15 (53%)
Findings Misrepresented by FDA	7/15 (47%)
Authors Themselves Concluded Raw Milk Unrelated	1/15 (7%)
Authors Concluded Regular Raw Milk Consumption Protective	1/15 (7%)
Alternative Explanations Discovered but Not Pursued	5/15 (33%)
No Evidence Anyone Consumed Raw Milk Products	2/15 (13%)
Outbreak Did Not Even Exist	1/15 (7%)
Did Not Show that Pasteurization Would Have Prevented Outbreak:	**15/15 (100%)**
Evidence that Pasteurization Would Not Have Prevented Outbreak	1/15 (7%)
Evidence that Pasteurization Was Not Necessary to Prevent Outbreak:	1/15 (7%)

Conclusions – The Failure of Pasteurization

Slide 42
http://www.cfsan.fda.gov/~ear/milksafe/milksa42.htm



The most important flaw in the reports that the FDA cites is that **none of them generates any evidence that pasteurization would have prevented the outbreak.** The FDA merely makes this assumption based on the flimsily supported statement above. **In reality, pasteurization is not in any way a foolproof means of eliminating pathogens.**

In 1999, Czechoslovakian researchers Binderova and Rysanek showed that if pre-pasteurization contamination is high, **dangerous levels of *L. monocytogenes* and *E. coli* O157:H7 can survive high-temperature short-time pasteurization.** Various *Bacillus* and *Clostridium* species and *Mycobacterium paratuberculosis* may also survive pasteurization. Heat-treatment can cause bacteria to enter into a state of dormancy from which they can potentially recover in the human intestine. **This state of dormancy can cause typical laboratory culture techniques to underestimate the actual presence of *E. coli* in heat-treated milk 100-fold.** These and other organisms can also contaminate milk after pasteurization. The production of cheese or other processed dairy products allows additional opportunities for contamination.

As we will see in the coming slides, pasteurized milk may actually be much more dangerous than raw milk.

Conclusions – Comparing Raw Milk to Pasteurized Milk

Between 1980 and 2005, 41 outbreaks were reported to the CDC attributing 19,531 illnesses to the consumption of pasteurized milk and milk products. This is 10.7 times the number of illnesses attributed to raw milk during the same period.

The FDA, CDC and USDA estimate that 0.5% of milk consumed is raw. This estimation assumes that no raw milk is sold in states where its sale is prohibited. If raw milk sales in these states are similar to other states, however, raw milk may represent 1% of the nation's milk sales.

Using both of these figures, the risk of foodborne illness associated with raw milk on a per serving basis is between 87% greater than that with pasteurized milk and 7% lower than that with pasteurized milk.

Because 93% of reports associating raw milk with illness that the FDA cites in this presentation either fail to generate a valid statistical association or fail to generate a positive test sample and 53% fail to generate both, **the association with raw milk may be greatly exaggerated.**

Adjusting for this bias, pasteurized milk may be between 1.1 and 15.3 times as dangerous as raw milk on a per serving basis.

Since 100% of the reports that the FDA cites fail to generate evidence that pasteurization would have prevented the outbreak, the risk of illness genuinely attributable to lack of pasteurization may approach zero.

Conclusions – Comparing Raw Milk

to Other Foods

Between 1998 and 2005, there were over 10,000 documented outbreaks that contributed to 199,263 documented cases of foodborne illness. Raw milk was associated with 0.4% of these cases.

Adjusting for the aforementioned biases, raw milk may have been genuinely associated with between 0.03% and 0.19% of these cases.

Again, since the FDA has presented no evidence that pasteurization would have prevented any of the outbreaks purportedly associated with raw milk, the risk genuinely attributable to lack of pasteurization may approach zero.

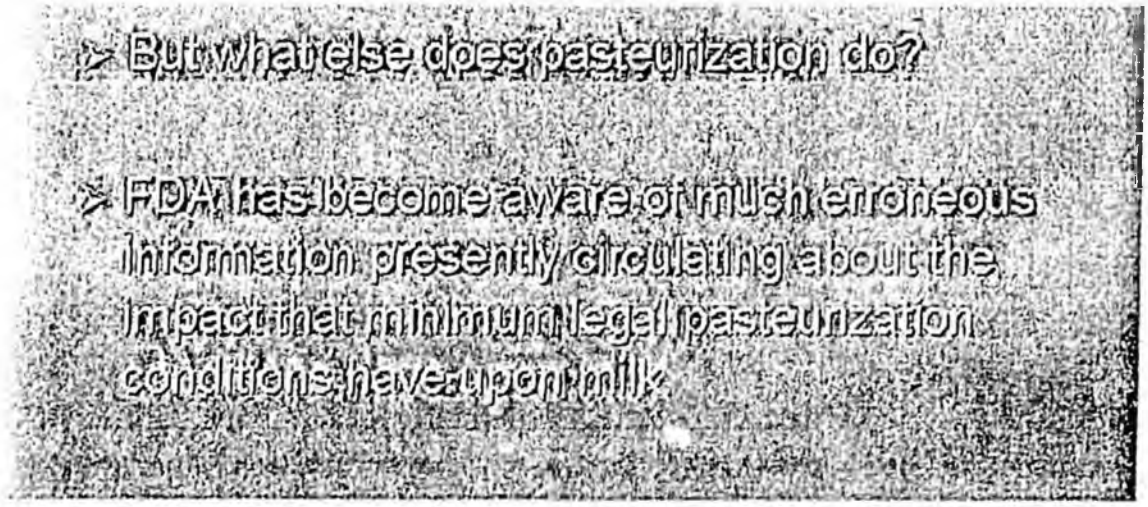
Conclusions – Putting It All in Perspective

Raw milk is clearly no more dangerous than other foods commonly consumed.

Yet there are no FDA warnings about the inherent dangers of deli meats; there are no executive orders prohibiting the interstate transport of chicken; no state legislation banning the sales of spinach; no consumer education campaigns to eliminate the attendance of flea markets; and no farmers being fined and jailed for the sale of root vegetables.

Producers and consumers of raw milk have a fundamental right to be treated fairly under the law that they are clearly being denied.

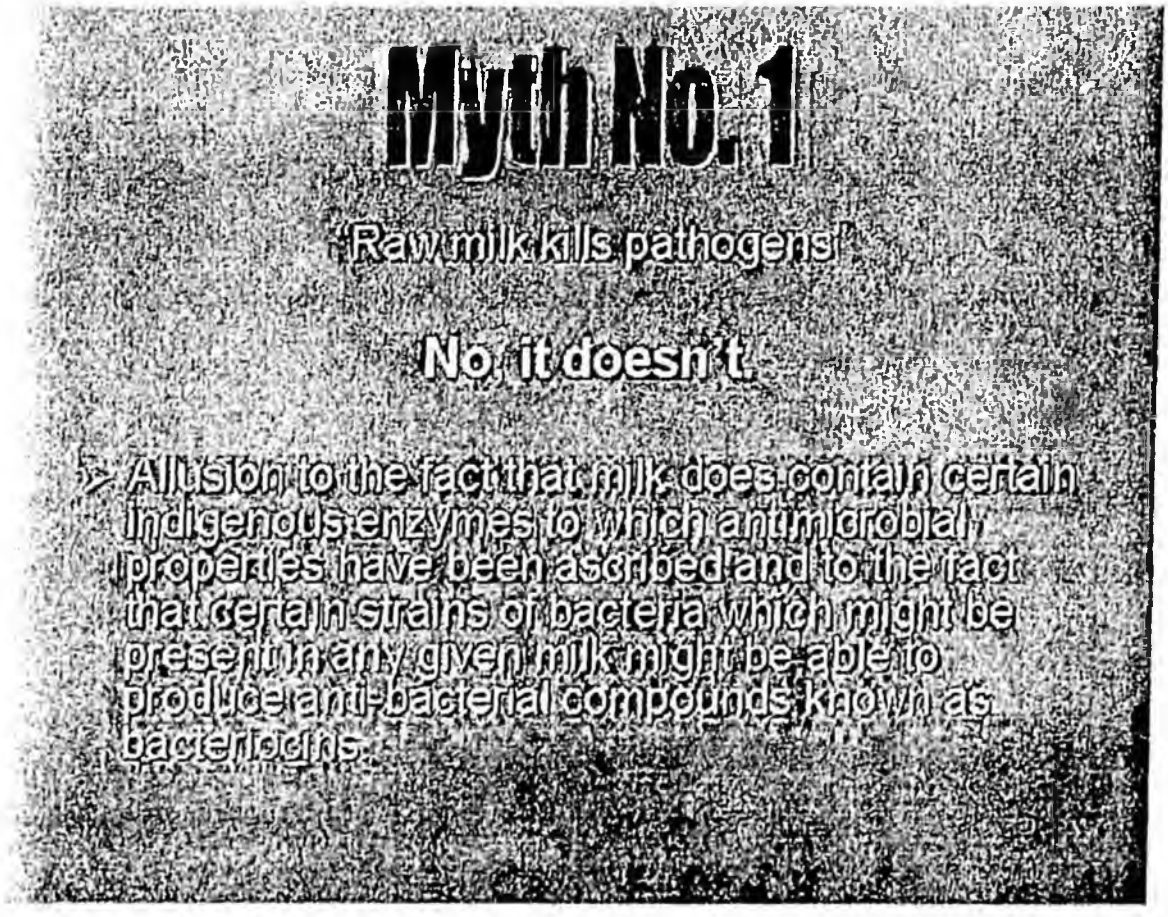
Slide 42
http://www.cfsan.fda.gov/~ear/milksafe/milksa42.html



The FDA does not provide references for the quotations in the following section and they are not necessarily statements associated with the Weston A. Price Foundation.

Although a few of them cannot be supported, **most of the "myths" that the FDA cites are indeed substantiated in the scientific literature.** Our comments follow.

Slide 43
http://www.cfsan.fda.gov/~ear/milksafe/milksa43.htm



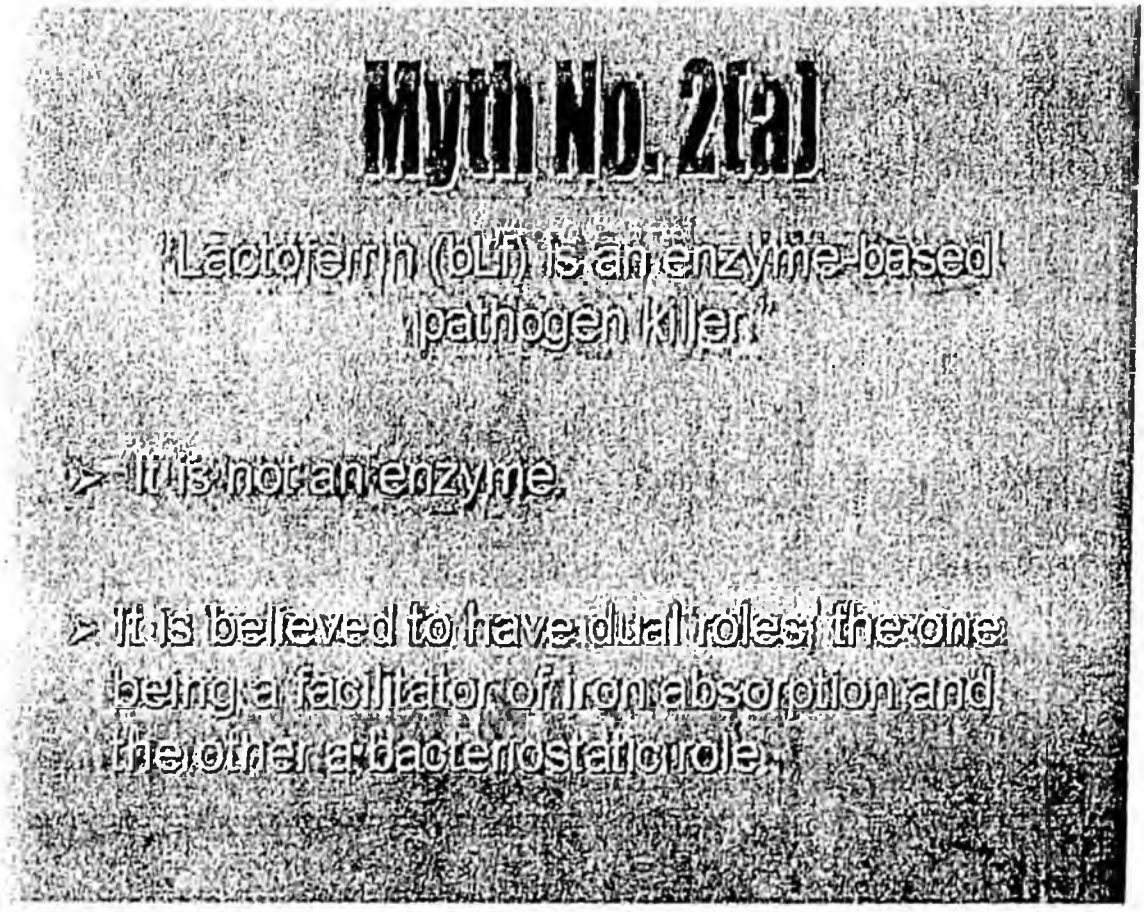
Doyle et al. (1982) showed that *C. jejuni* survived longer in sterile milk than in raw milk and suggested that the microflora of the latter "may have produced metabolites toxic to *C. jejuni*." They also noted that, "unlike sterile milk, raw milk contains lactoperoxidase," which "produces metabolites that are toxic to many gram-negative bacteria."

BSK Food & Dairy Laboratories (2002) inoculated raw colostrum and raw milk samples provided by Organic Pastures, a family-owned dairy from Fresno, CA with a mix of three pathogens and monitored the bacterial counts over the course of 14 days. The laboratory concluded, "Raw colostrum and raw milk do not appear to support the growth of Salmonella, *E. coli* O157:H7 or *Listeria monocytogenes*."

In both studies, pathogen counts declined over time and in some cases reached below the limit of detection within a week.

Raw milk may not kill pathogens but it contains important substances that do.

Slide 44
http://www.cfsan.fda.gov/~ear/milksafe/milksa44.htm



According to a recent review in the *Journal of Experimental Therapeutics and Oncology*, there is evidence that a portion of the lactoferrin molecule acts as a serine protease. Since serine protease activity is enzymatic and since it is responsible for part of the molecule's antibacterial effects, lactoferrin is technically an "enzyme-based pathogen-killer."

Lactoferrin, according to this review, exhibits fungistatic, bacteriostatic, bactericidal, and antiviral properties and inhibits the growth of parasites.

It is effective against *E. coli*, *S. typhimurium*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Vibrio cholerae*, *Haemophilus influenzae*, *S. aureus*, *Klebsiella pneumoniae*, *Candida albicans*, *Candida crusei*, *Tinea pedis*, *Toxoplasma gondii*, *Plasmodium falciparum*, *Herpes simplex*, hepatitis C virus, human papillomavirus, and various other pathogens.

It is not effective against gram-positive bacteria such as *Bifidobacterium* and *Lactobacillus* species. These species are friendly to the human intestine.

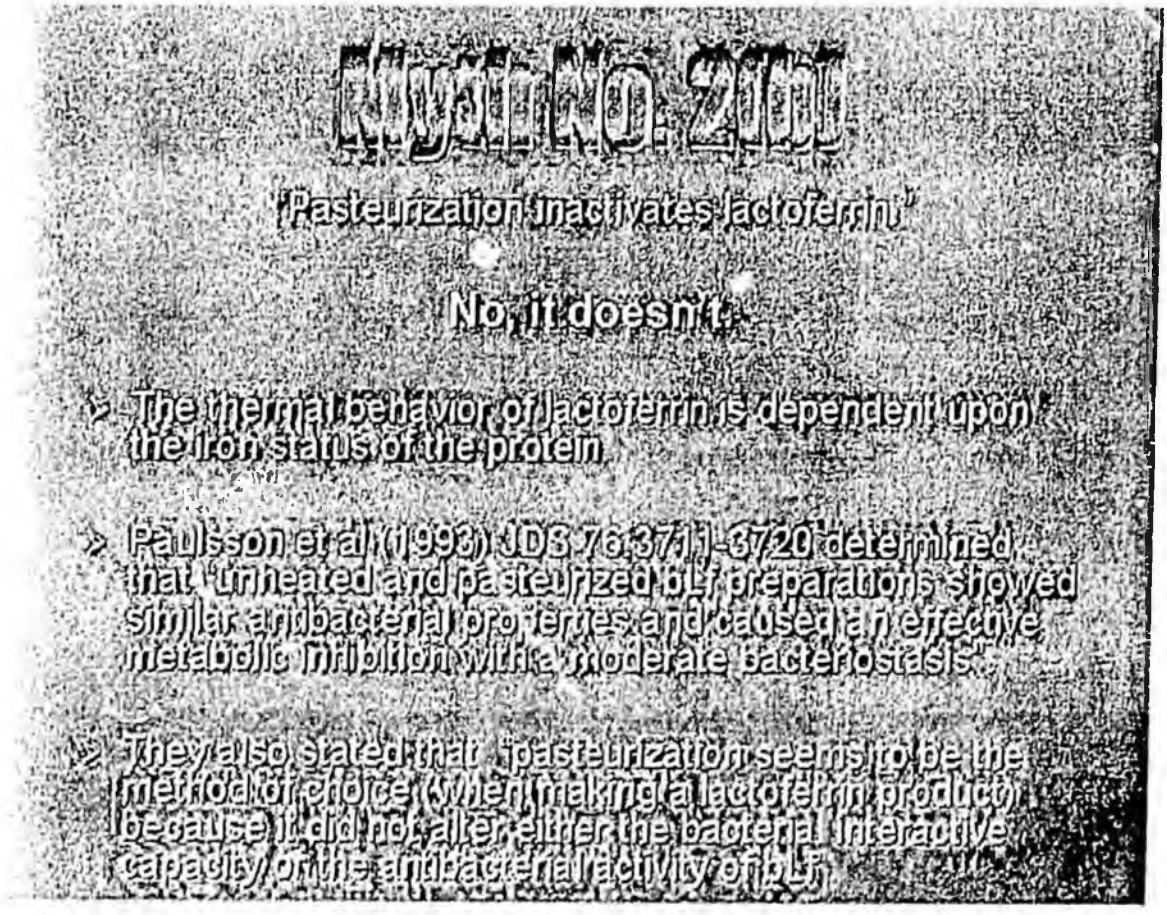
Slide 44 Response Continued

In 2003, the FDA approved the use of a lactoferrin-based anti-microbial spray to combat *E. coli* O157:H7 contamination in the meat industry. The FDA press release praised the product as an innovative way to protect the nation from foodborne illness.

"Innovative technology is a critical building block in preserving the strong foundation of the U.S. food supply," said Dr. Lester Crawford, Deputy Commissioner of the Food and Drug Administration. "We must continue to encourage scientific research and new technology to maintain this nation's safe food supply."

Since the dawn of mammalian history, nature has provided this "innovative technology" to nursing infants to protect their vulnerable and sensitive digestive systems from the insults of invading pathogens. Perhaps this is one reason why responsibly handled raw milk rarely leads to genuine cases of foodborne illness.

Slide 45
http://www.cfsan.fda.gov/~ear/milksafe/milksa45.htm

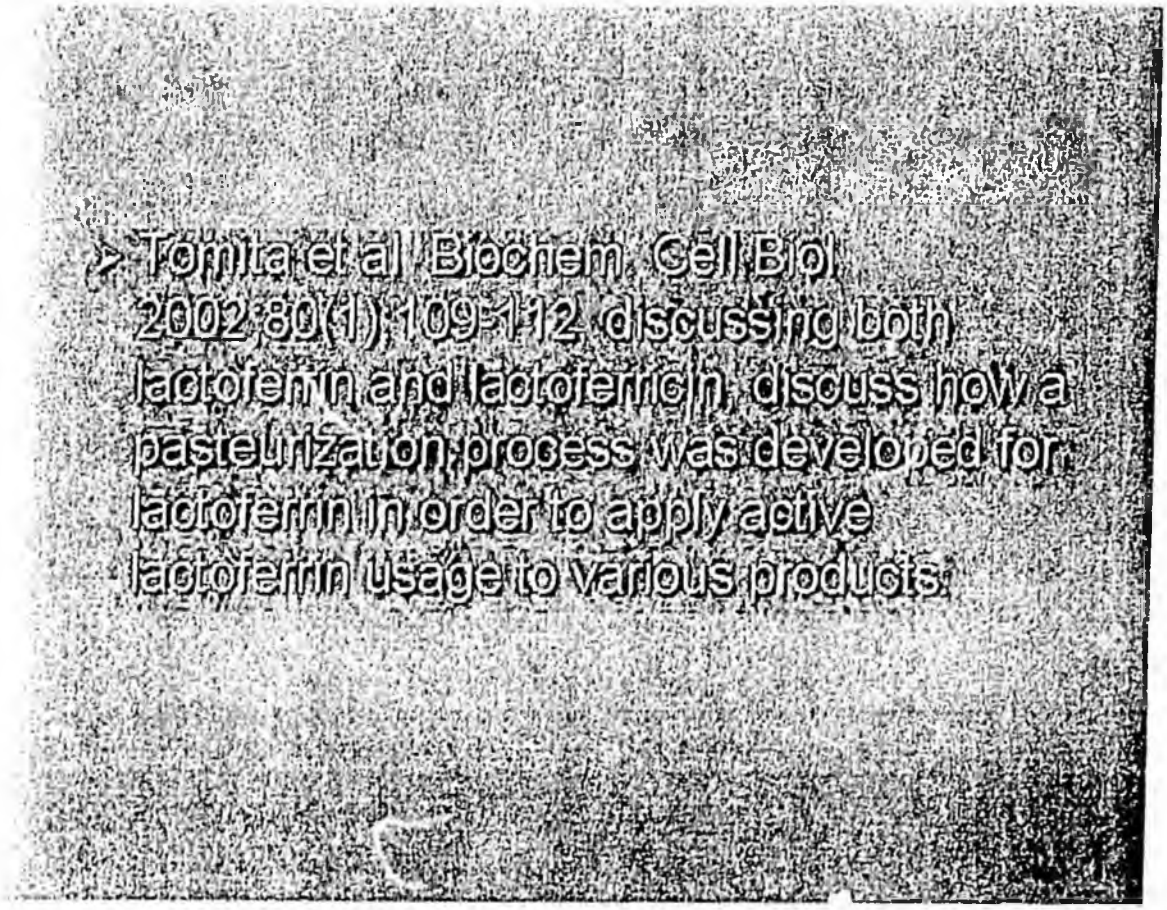


The authors of this study used purified lactoferrin, not milk. Although lactoferrin is more heat-stable when the iron is removed, accomplishing this requires incubating purified lactoferrin with citric acid at 5 degrees Celsius for 24 hours and running it through a gel filtration system. Such a "lactoferrin product" bears very little resemblance to the milk one would find in a grocery store.

In 1977, Ford et al. showed that classic pasteurization of human milk at 62.5 degrees Celsius for 30 minutes destroys 65% of the lactoferrin. They did not evaluate the antibacterial efficacy of the remaining 35%, which may have been damaged or completely destroyed.

Heating human milk at 70 degrees Celsius for 15 minutes caused 96% destruction of its lactoferrin. Again, we do not know whether the remaining 4% retained its antibacterial potency.

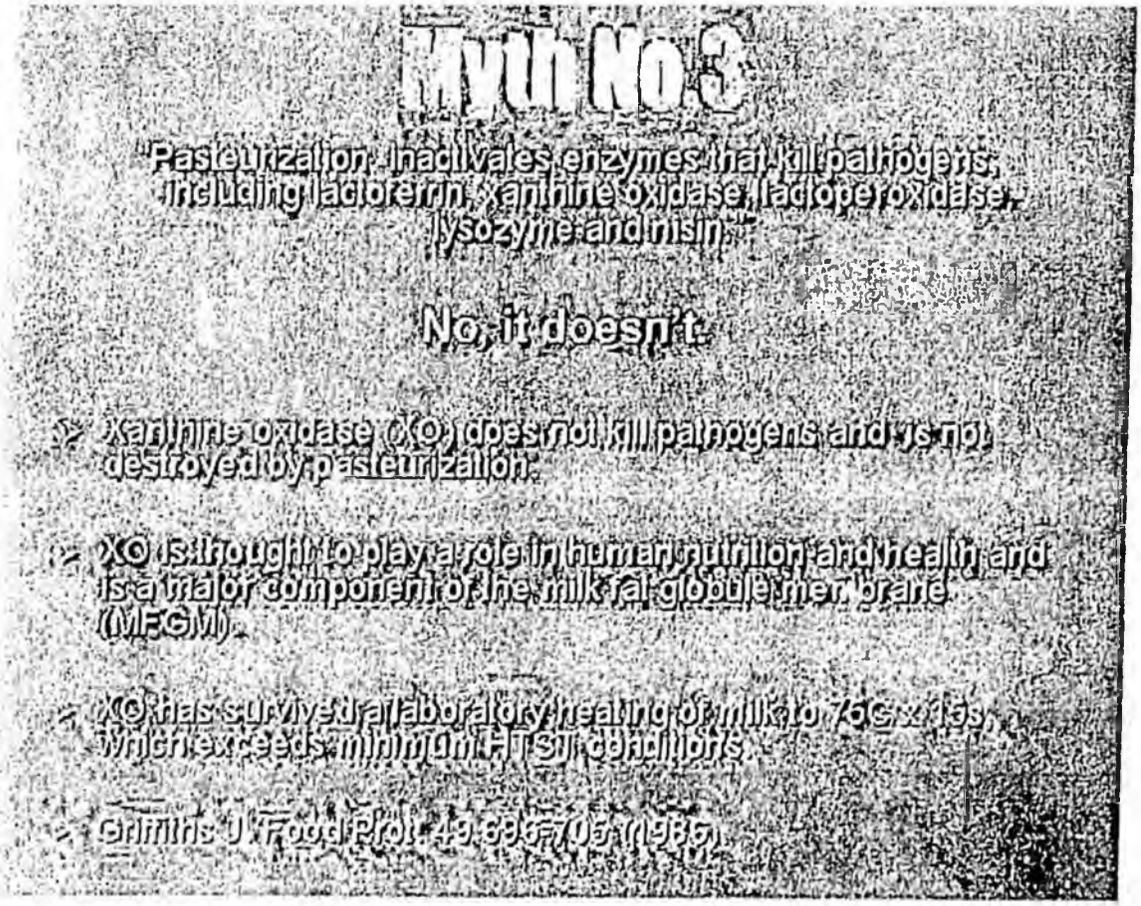
Slide 46
http://www.cfsan.fda.gov/~ear/milksafe/milksa46.htm



These authors patented a process in which the pH of a solution containing purified lactoferrin is lowered to 4.0 before being pasteurized. They found that lactoferrin "is stable against heat treatment under acidic conditions, while heat treatment at a neutral pH causes denaturation of the protein."

In the introduction to the original 1991 paper describing this process, they stated that "it is well known that heat treatment of milk and milk protein solutions affects the functional properties of the native proteins." In the discussion, they stated that **"it has been widely accepted that [lactoferrin] is easily denatured by heat treatment" and cited several studies demonstrating "virtually complete destruction" of lactoferrin in milk upon pasteurization.**

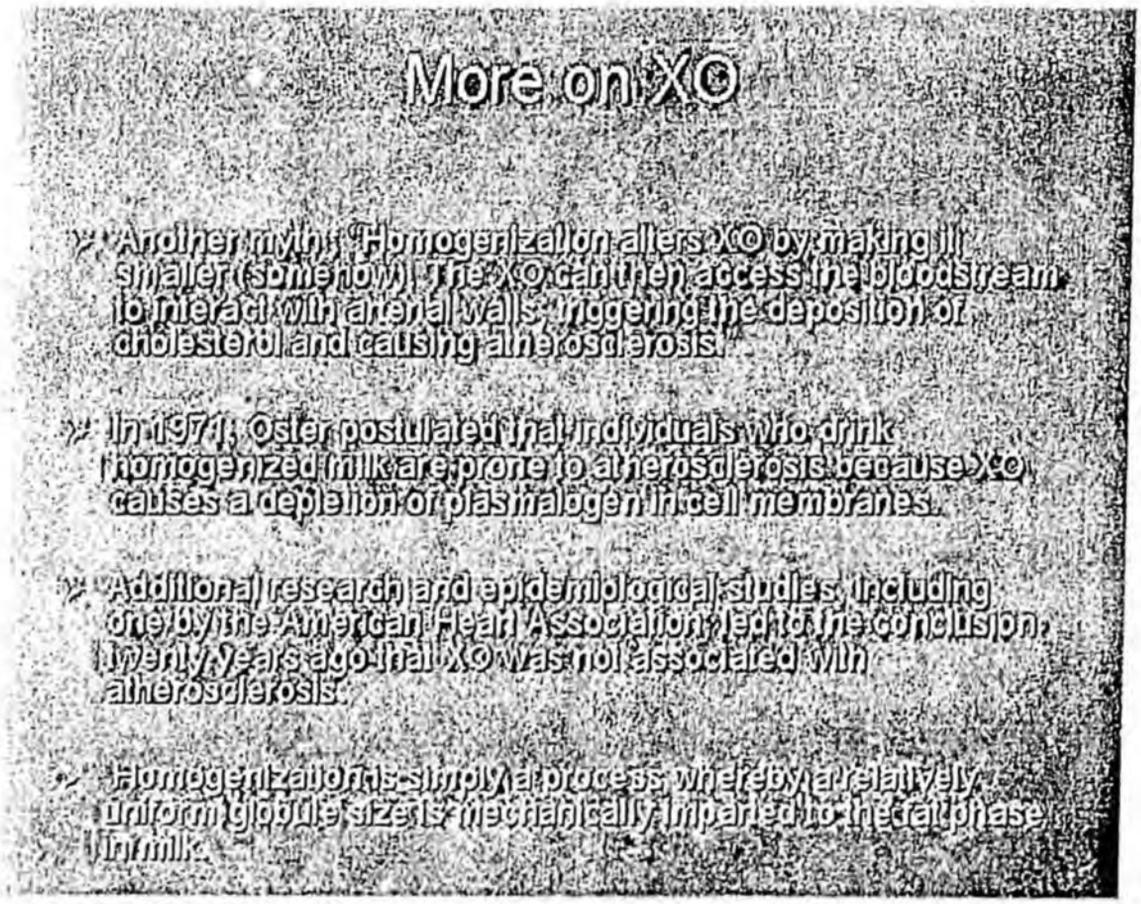
Slide 47
http://www.cfsan.fda.gov/~ear/milksafe/milksa47.htm



Cerbulis and Farrell (1977) showed that homogenization only destroyed xanthine oxidase when it was preceded by heat treatment. Pasteurization and homogenization of milk together destroyed 69% of the activity of this enzyme.

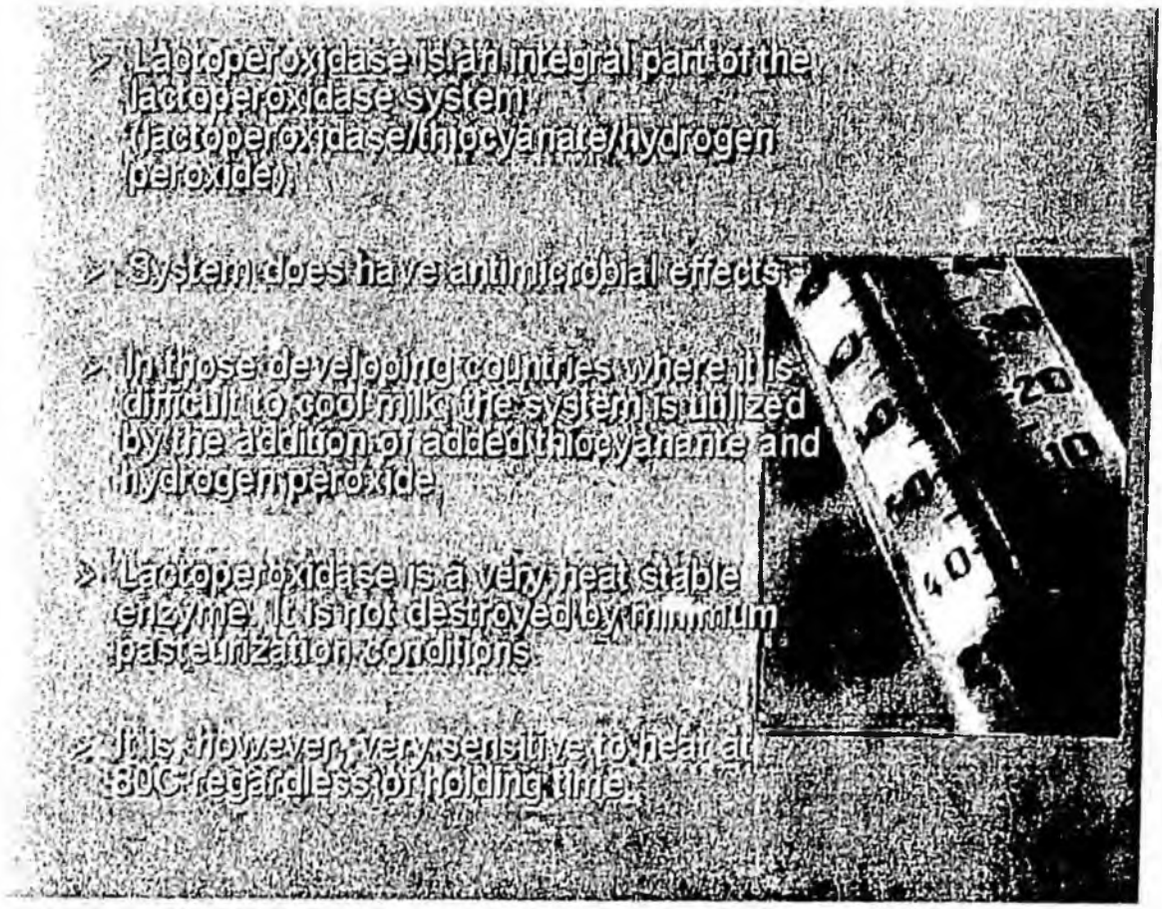
Stevens et al. (2000) showed that xanthine oxidase "showed potent growth-inhibiting activity" against *E. coli* and *Salmonella enteritidis* at concentrations present in raw milk.

Slide 48
http://www.cfsan.fda.gov/~ear/milksafe/milksa48.htm



We agree that the scientific data does not support this theory. A critique of this theory by Mary G. Enig, PhD, is available on the RealMilk.Com site at http://www.realmilk.com/homogenization.html.

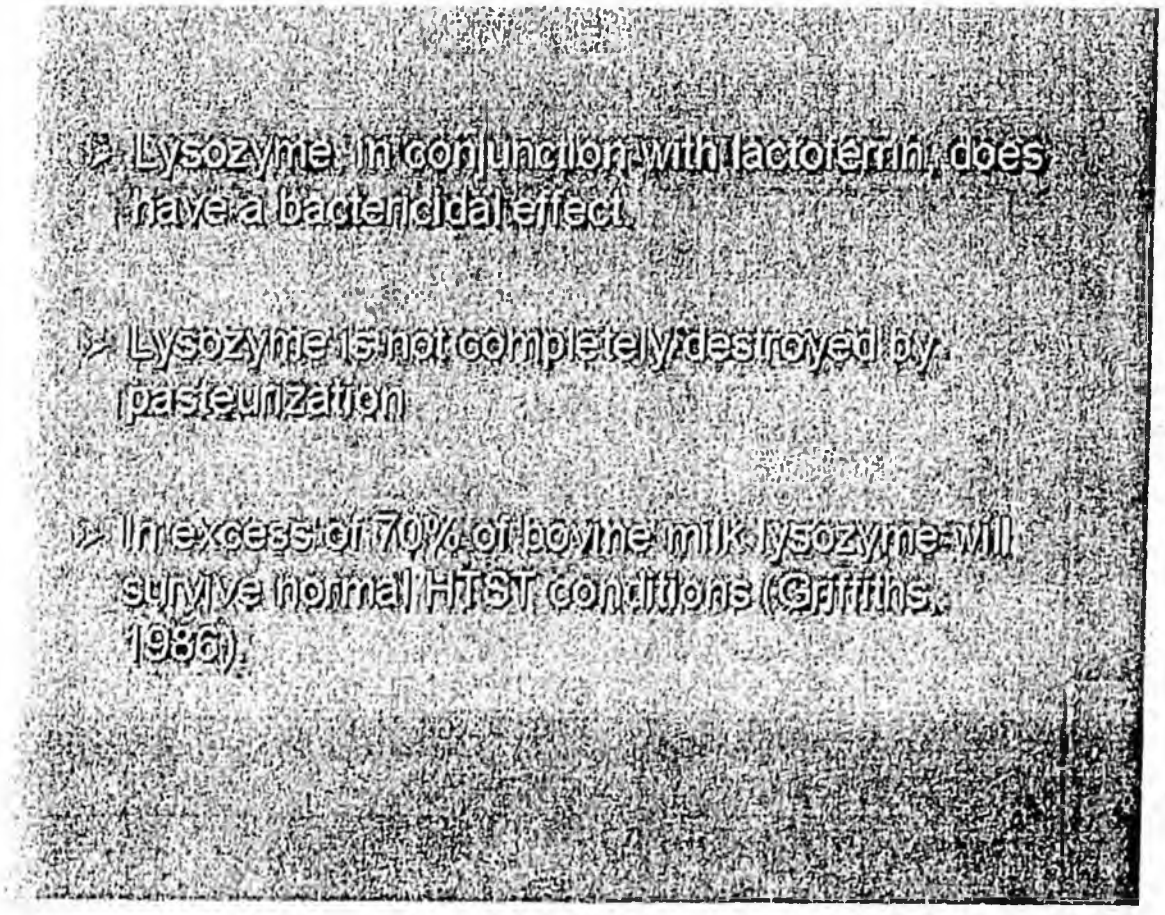
Slide 49
http://www.cfsan.fda.gov/~ear/milksafe/milksa49.htm



Barrett et al. (1999) showed that HTST pasteurization of cow milk destroys 30% of the lactoperoxidase (LP). Marks et al. (2001) showed that ultra-high temperature (UHT) pasteurization of milk completely destroys LP.

Using buffalo milk, Nieuwenhove et al. (2004) showed that classic pasteurization destroys 16% of the lactoperoxidase and HTST pasteurization destroys 80% of the lactoperoxidase.

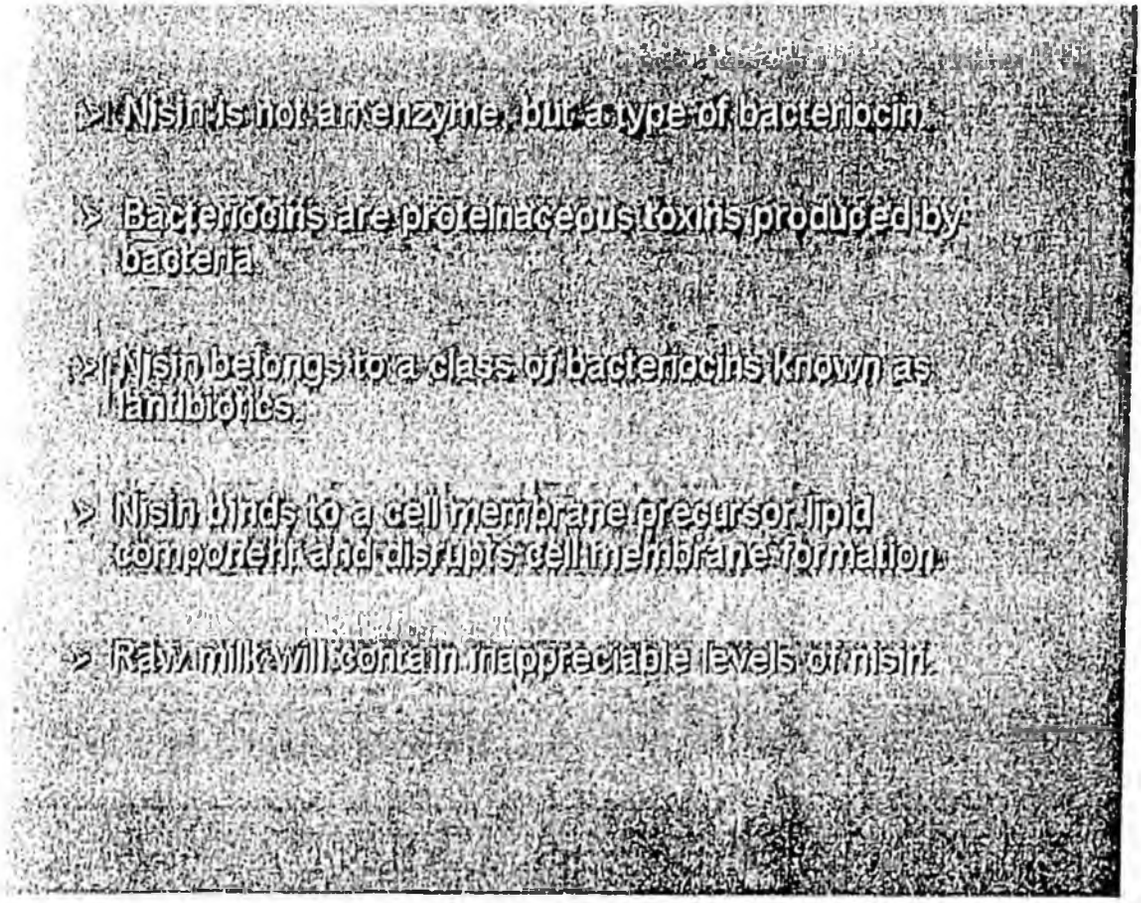
Slide 50
http://www.cfsan.fda.gov/~ear/milksafe/milksa50.htm



If pasteurization destroys 30% of the lysozyme in milk, then it is not a "myth" that pasteurization inactivates lysozyme. If lysozyme requires lactoferrin to carry out its function, the substantial destruction of lactoferrin induced by pasteurization must render the remaining lysozyme much less effective.

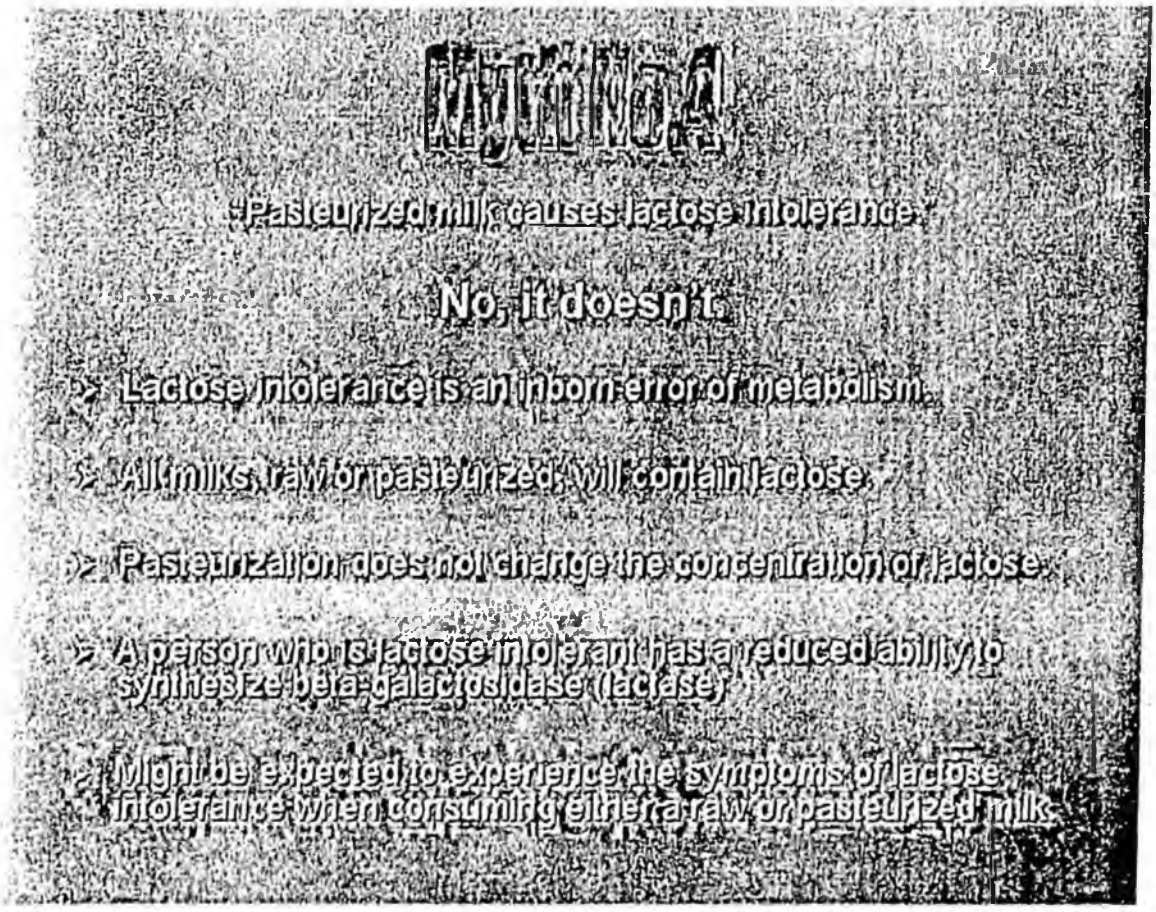
Nieuwenhove et al. (2004) showed that both classic and HTST pasteurization of buffalo milk completely inactivates lysozyme.

Slide 51
http://www.cfsan.fda.gov/~ear/milksafe/milksa51.htm



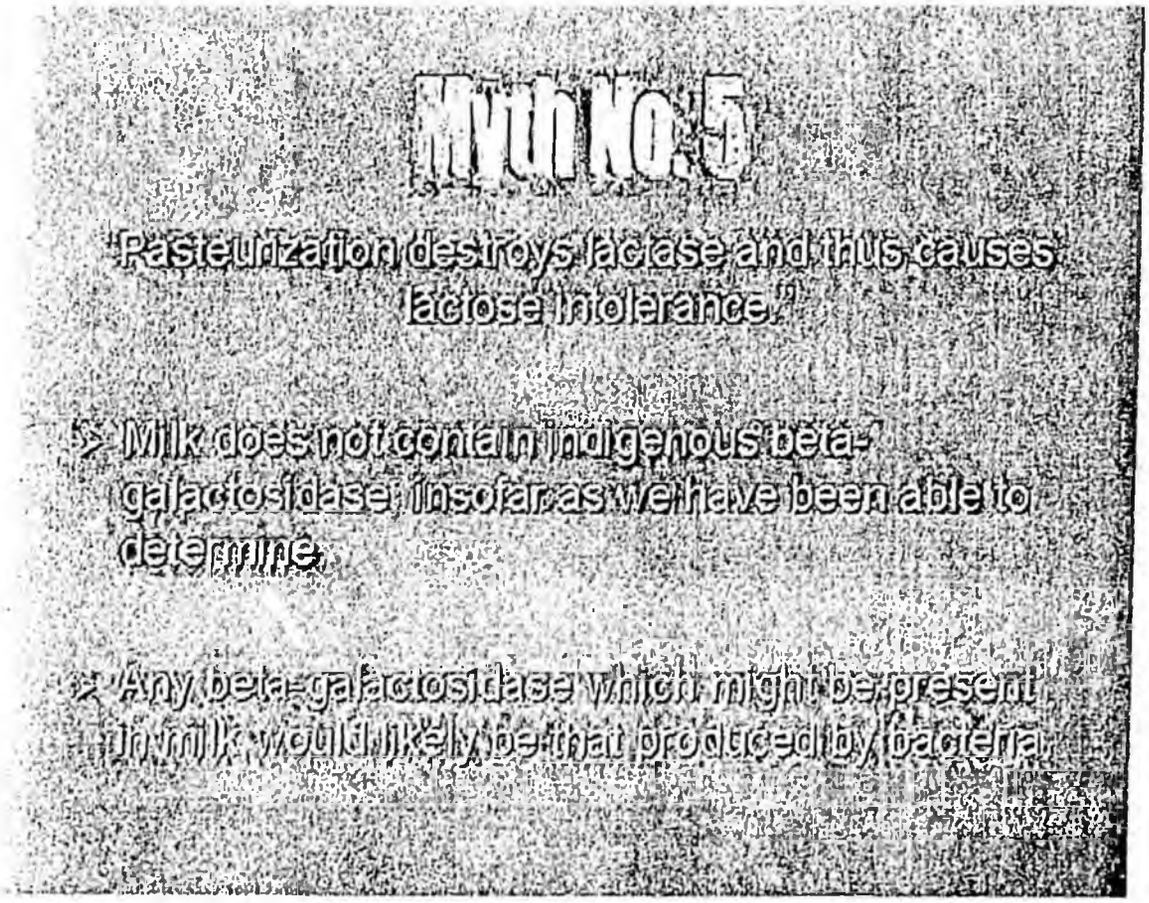
Lactococcus lactis produces nisin as a defense against other types of bacteria such as *L. monocytogenes* that are pathogenic to humans. **Pasteurization destroys *L. lactis* and Bhatti et al. (2004) showed that nisin is only effective against *L. monocytogenes* in non-homogenized milk.**

Slide 52
http://www.cfsan.fda.gov/~ear/milksafe/milksa52.htm



While pasteurized milk will not cause lactose intolerance *per se*, many people report more easily digesting raw milk, which naturally contains the enzyme lactase.

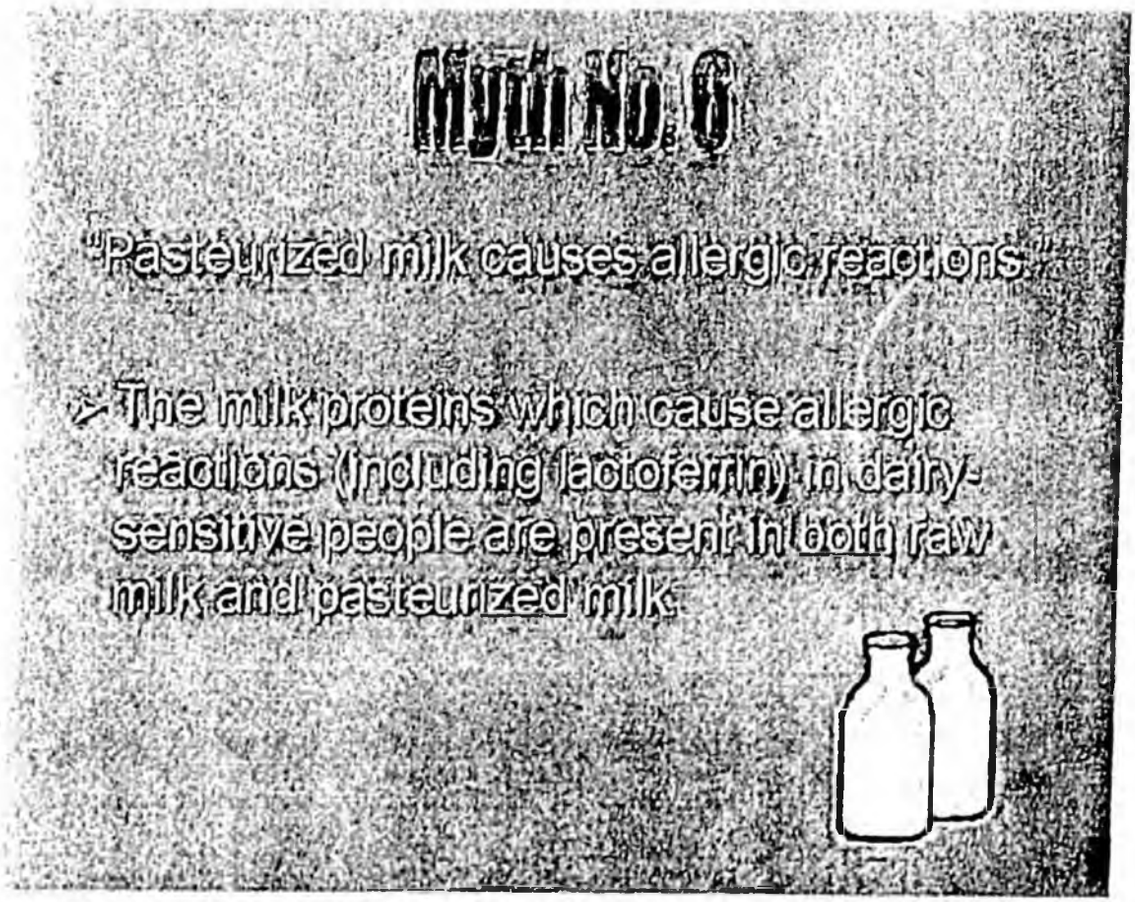
Slide 53
http://www.cfsan.fda.gov/~ear/milksafe/milksa53.html



Raw milk naturally contains healthy bacteria that produce lactase. The fact that the lactase is produced by bacteria does not make it any less functional than if it were synthesized directly by the mammary gland.

Research on the effects of heat on microbial lactase present in milk is lacking. Mahoney and Wilder (1989), however, showed that losses are incurred at 60 degrees Celsius, which is a considerably lower temperature than that typically used for pasteurization (72 degrees Celsius).

Slide 54
http://www.cfsan.fda.gov/~ear/milksafe/milksa54.htm



Although there may be insufficient evidence to claim that pasteurized milk is more allergenic than raw milk, there is evidence that raw milk prevents the development of allergic disorders in general.

Riedler et al. (2001) published a study in *The Lancet* showing that **children who drank "farm milk" – independent of other types of exposure to farming environments – had a 52% lower risk of asthma, a 57% lower risk of having had at least one wheeze attack in the past year, a 76% lower risk of hay fever, a 58% lower risk of having had a runny nose and itchy eyes in the past year, and an 85% lower risk of allergies to cows, dust mites, cat dander, and pollen.**

The authors noted that "farm milk" is "usually raw" and contains more bacteria than pasteurized milk. They suggested that "the ingestion of non-infectious microbial components," in raw milk or the milk's effects on intestinal flora might protect against the development of allergies.

Slide 55
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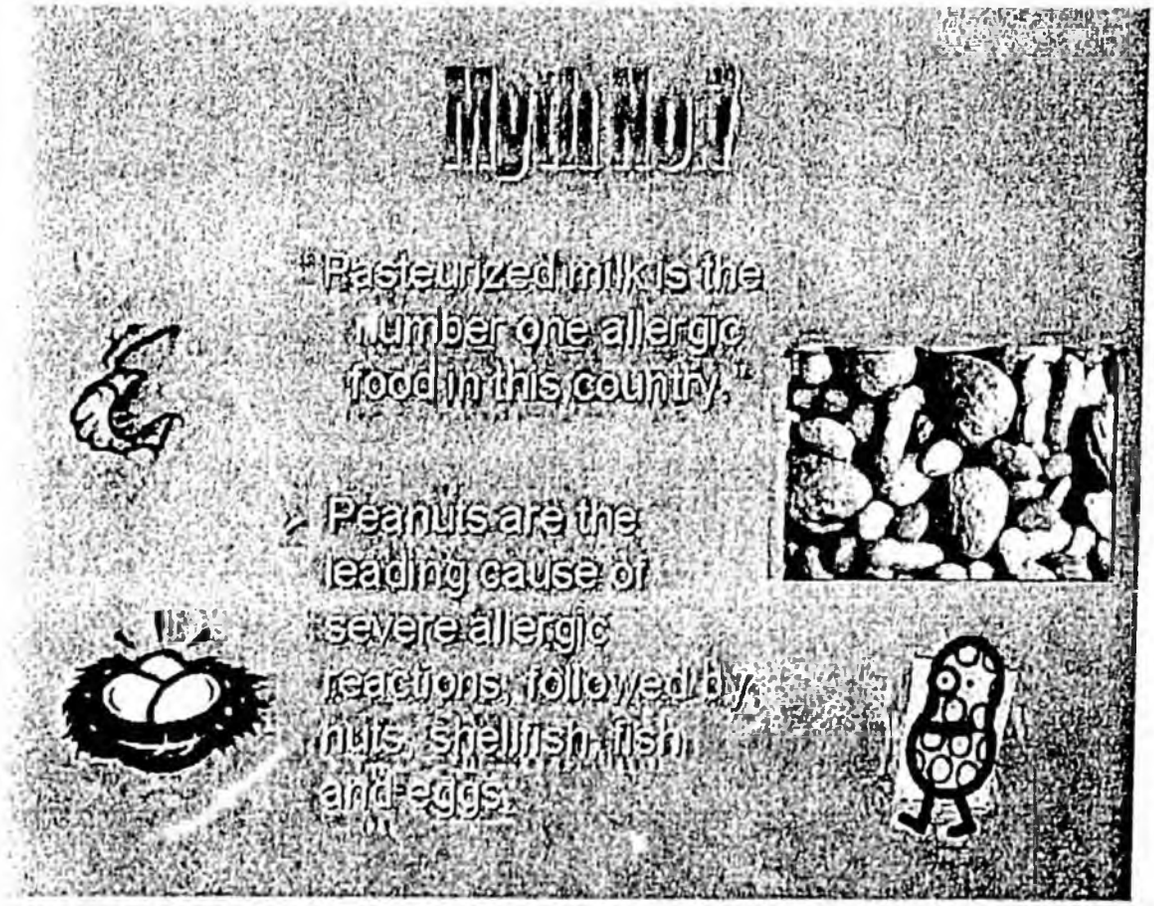
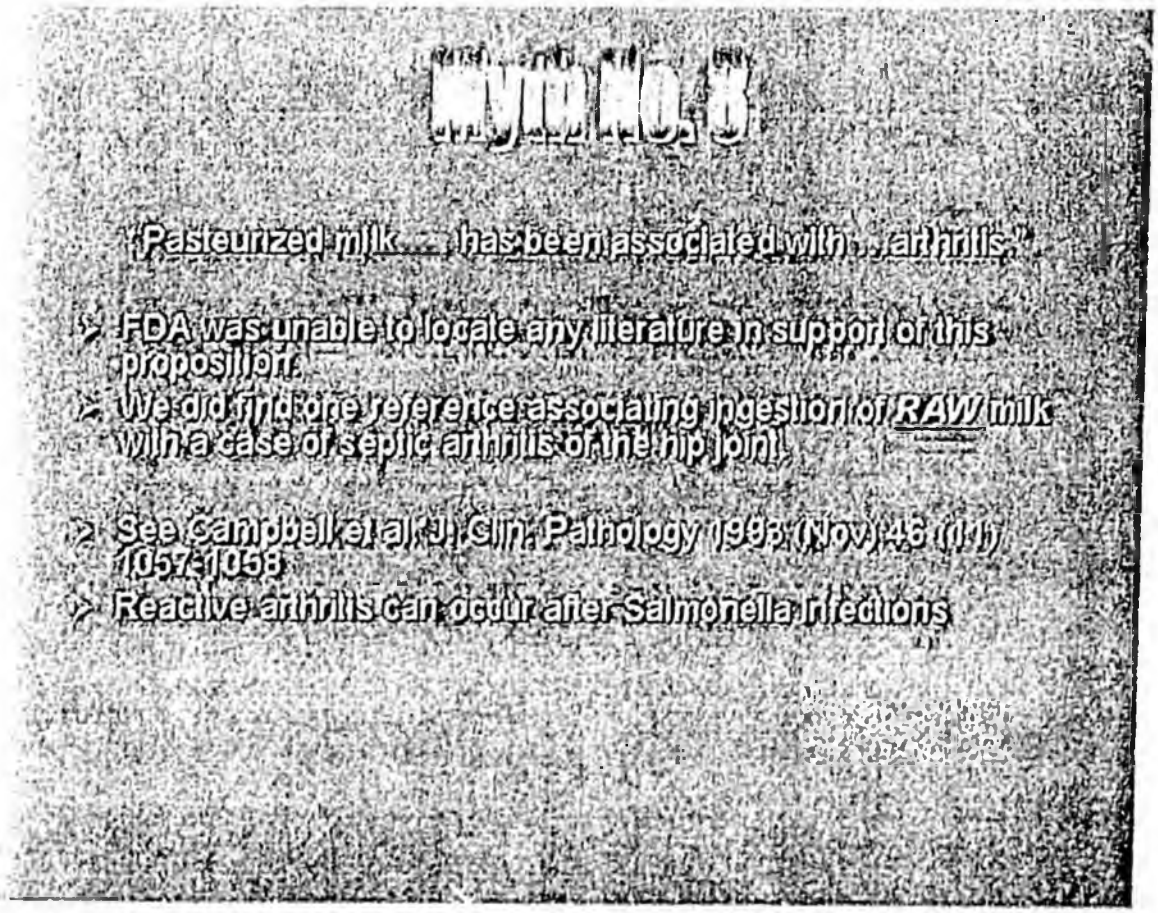


We cannot defend this statement as it is quoted; pasteurized milk, however, is still a major cause of allergic reactions.

Slide 56
http://www.cfsan.fda.gov/~ear/milksafe/milksa56.htm



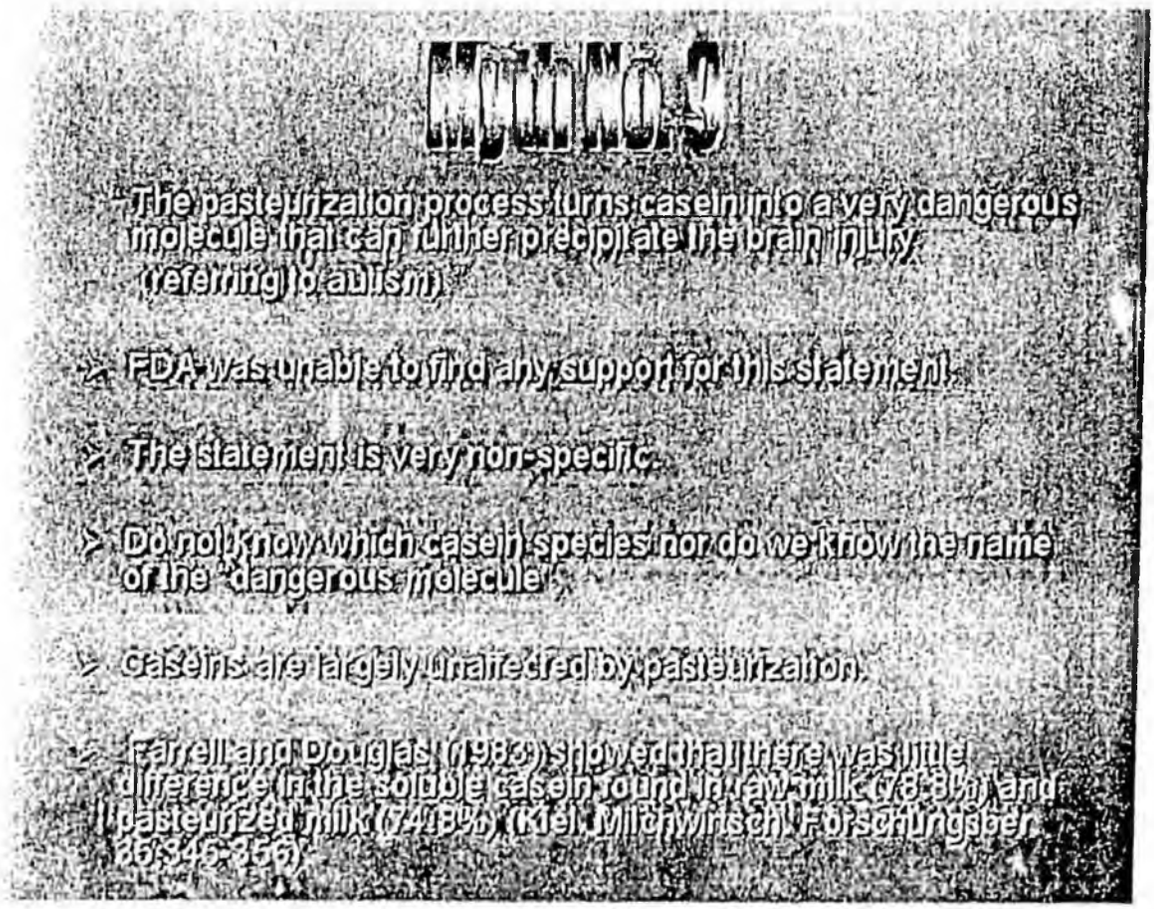
The report merely established that the septic arthritis patient came from a farming community and drank unpasteurized milk exclusively.

The infecting organism, *Streptococcus lactis (Lactococcus lactis)*, is used industrially in fermented milk products such as cheese, yogurt and kefir. As the authors stated, it "is a rare cause of disease in men, and there has been only one previous report of a serious *Streptococcus lactis* infection." If the mere presence of the organism was to blame, commonly consumed fermented milk products would be far more dangerous than raw milk.

The largest *Salmonella* outbreak in the nation's history was due to pasteurized milk. It infected more people than all outbreaks involving any type of organism attributed to raw milk between 1980 and 2005 combined. It would logically follow that, statistically, reactive arthritis has been much more likely to result from pasteurized milk than from raw milk.

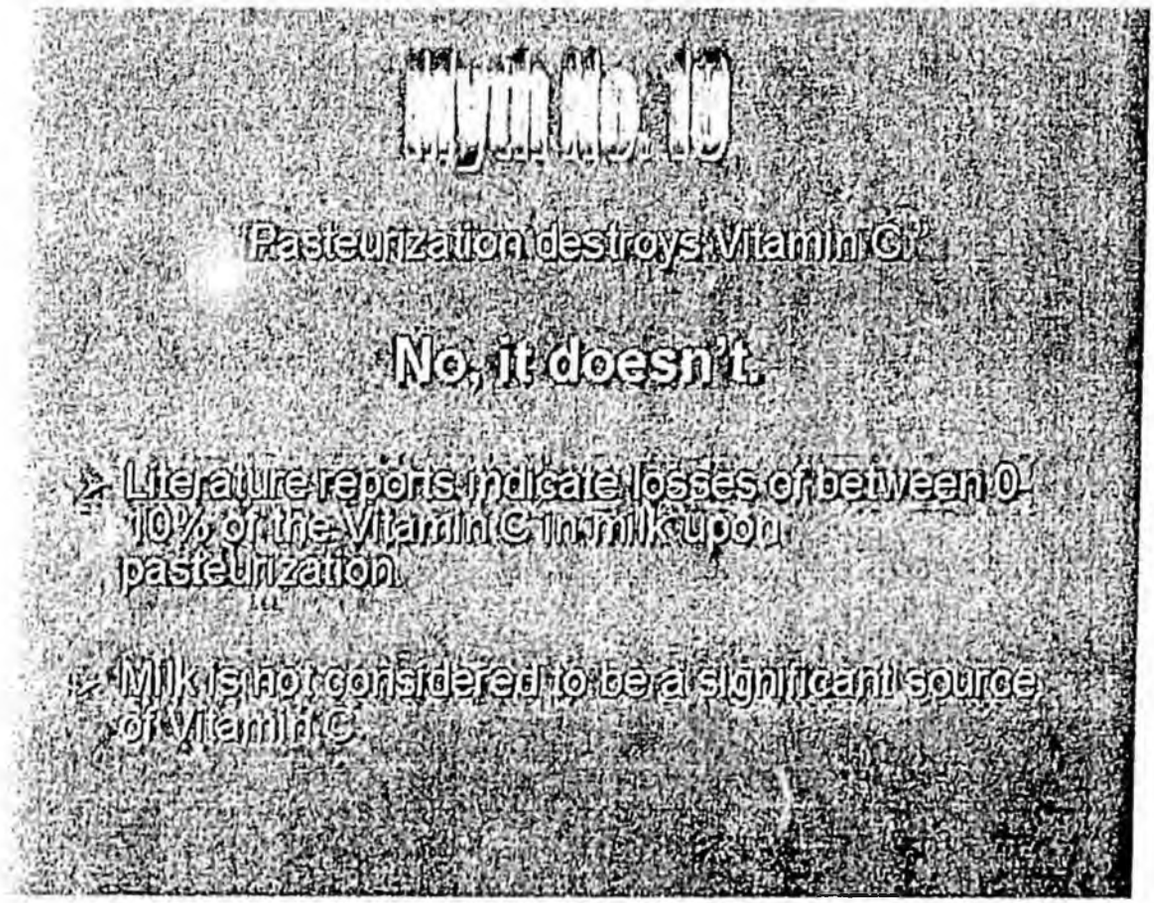
Research carried out in 1944 indicated that raw cream has anti-arthritic effects but heated cream does not.

Slide 57
http://www.cfsan.fda.gov/~ear/milksafe/milksa57.htm



While the statement addressed is poorly formulated, **there may be a connection between milk pasteurization and autism.** Pasteurization destroys *L. lactis* and other members of the lactic acid bacteria system indigenous to milk. These bacteria produce enzymes that break down the casein molecule, liberating and in some cases further degrading biologically active peptides that have been associated with autism. Friendly bacteria from raw milk could partially pre-digest the casein within it or could alter the intestinal flora, enhancing the individual's digestion of casein.

Slide 58
http://www.cfsan.fda.gov/~ear/milksafe/milksa58.htm

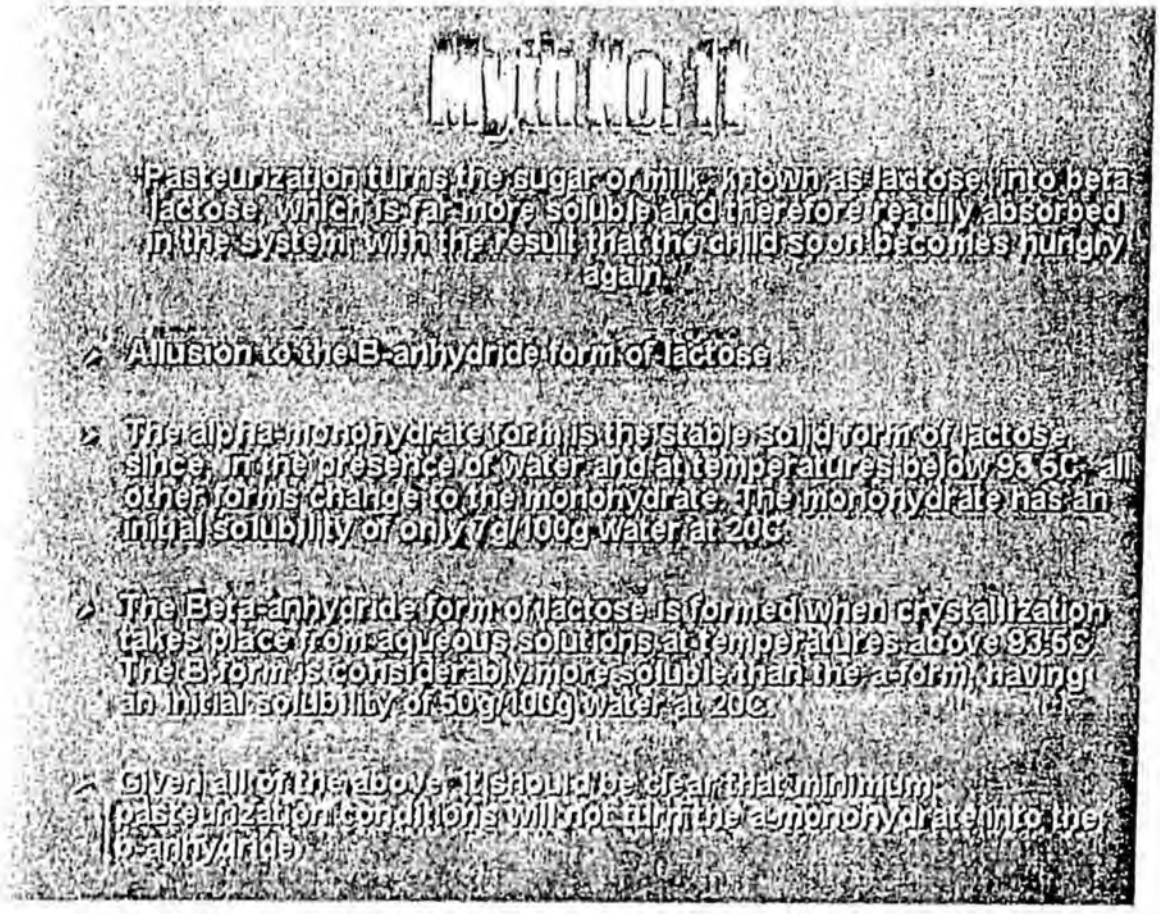


According to a recent review (2001) in *Pediatrics,* the official journal of the American Academy of Pediatrics, it is **"without doubt" that "the explosive increase of infantile scurvy during the latter part of the 19th century coincided with the advent of usage of heated milks and proprietary foods."**

In 1914, Alfred Hess of the Hebrew Asylum in New York noted several cases of scurvy among infants fed on pasteurized milk. Hess experimentally demonstrated that raw milk, orange juice and potatoes could each effectively cure scurvy and that pasteurization rendered milk ineffective.

Feeding experiments assessing the effects of a food on a biological outcome such as scurvy are superior to laboratory tests assessing the amounts of a given chemical within the food. Whether pasteurization causes direct loss of some vitamin C, alters its bioavailability, or alters other compounds such as hydroxyproline that could potentially reduce the need for vitamin C, the superior biological efficacy of raw milk for preventing and treating scurvy is experimentally established.

Slide 59
http://www.cfsan.fda.gov/~ear/milksafe/milksa59.htm

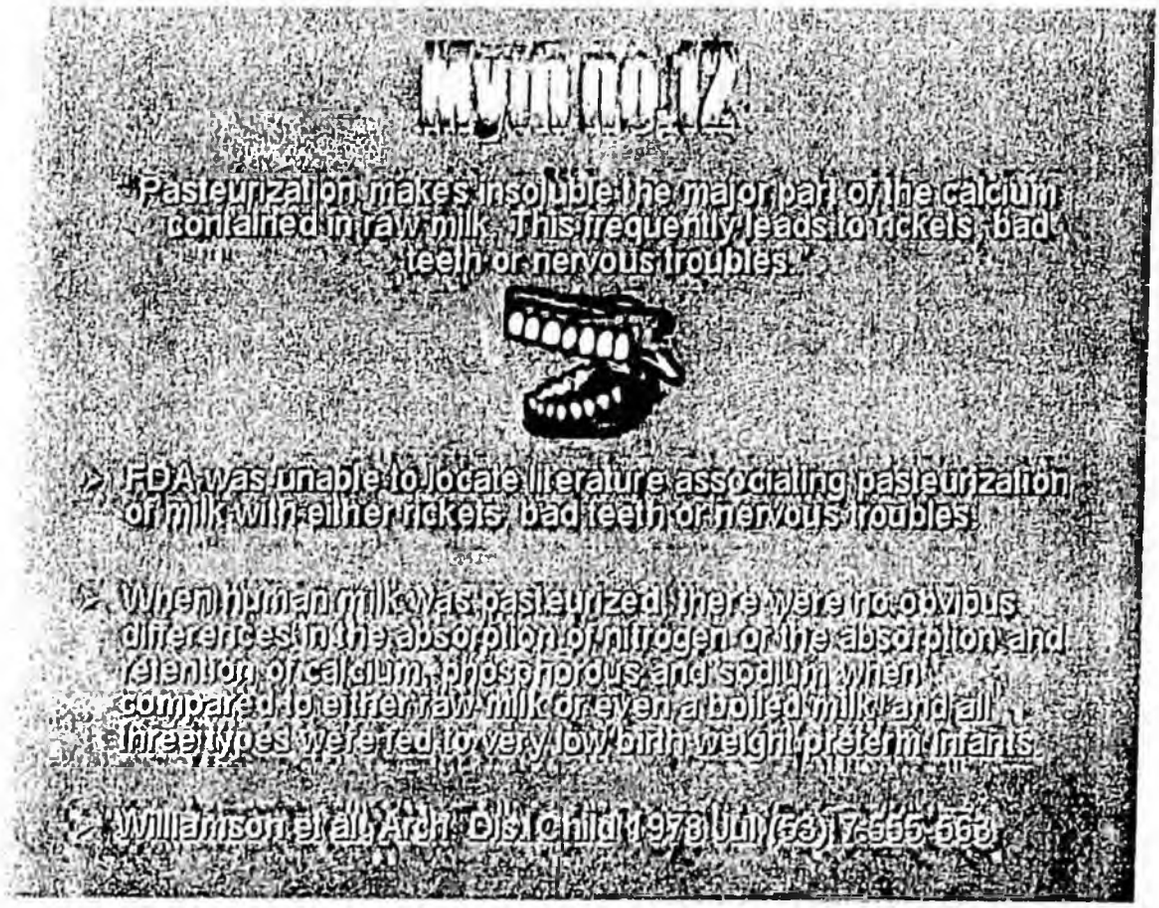


Although the original statement (quoted from a 1938 article published in a popular science journal) does not appear to be correct, spray or drum drying milk increases the content of beta-lactose in proportion to the length of time spent drying. Powdered milk can therefore contain up to 90% beta-lactose.

The original statement may be taken from the observation that the reversible inter-conversion between the alpha and beta forms of lactose reaches equilibrium instantaneously when milk is heated to 75 degrees Celsius.

On a related note, according to a 1948 review in the *Journal of Dairy Science,* both boiling and homogenization cause milk to be digested more rapidly and to exit the stomach more quickly, but not to be digested more completely. It is probably true, then, that raw milk contributes to longer-lasting satiety than does pasteurized and homogenized milk.

Slide 61
http://www.cfsan.fda.gov/~ear/milksafe/milksaf0.htm

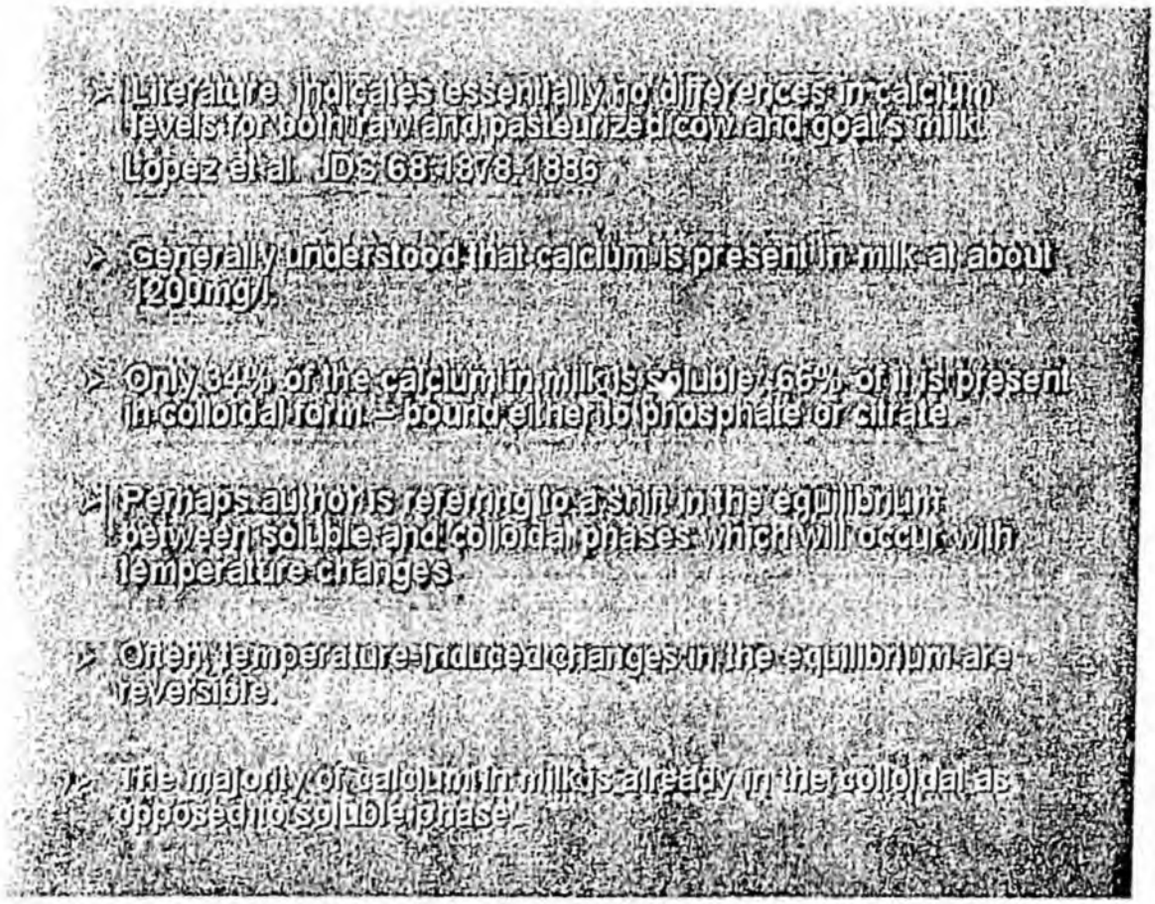


Although this study did not demonstrate a statistically significant difference in mineral absorption, **it did show that fat absorption was reduced by one third when infants were fed pasteurized or boiled milk**, which the authors attributed to the destruction of heat-sensitive lipase enzymes that are indigenous to raw milk.

Calcium absorption correlated with fat absorption, so the four infants whose fat absorption was most compromised on the pasteurized and boiled milk diets did indeed demonstrate greater calcium absorption while consuming raw milk.

Infants also gained weight 33% more rapidly during the week they were fed raw milk than during the weeks they were fed pasteurized or boiled milk.

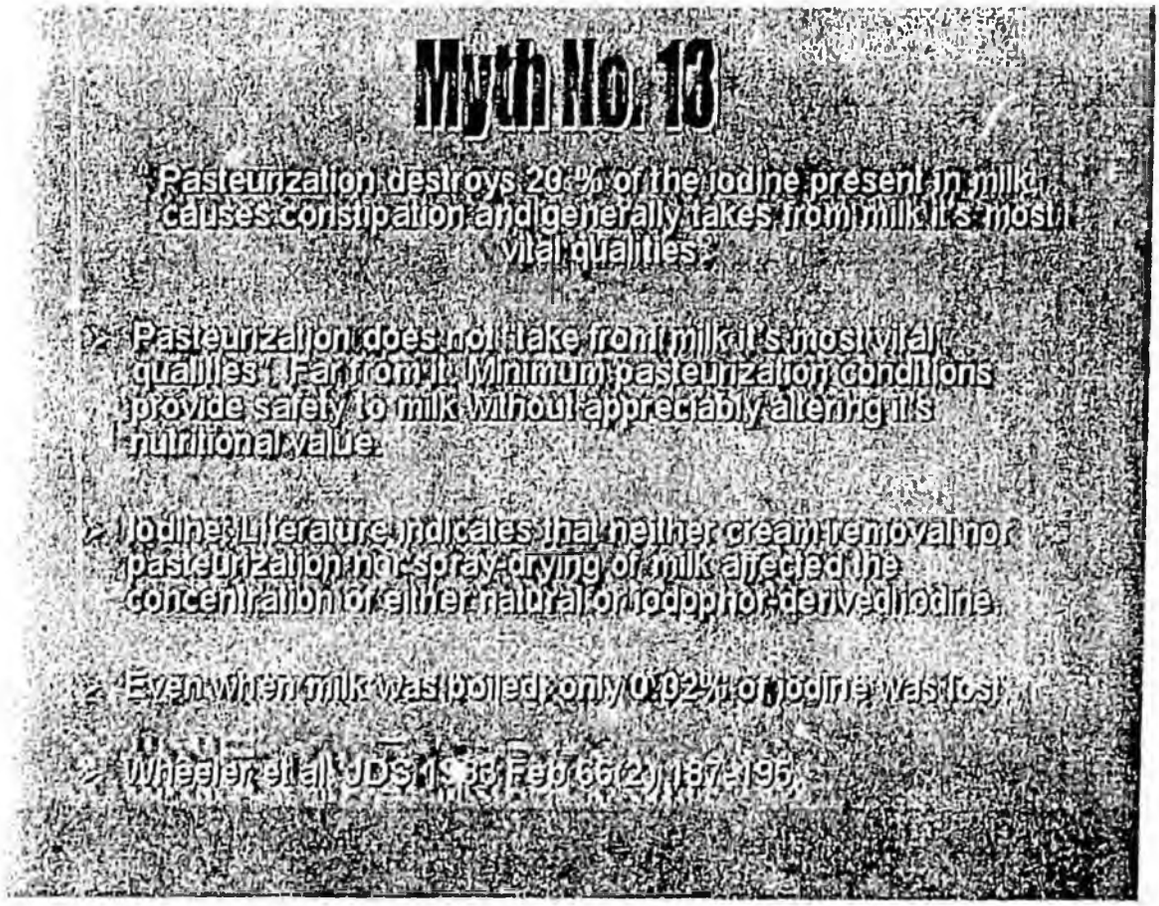
Slide 61
http://www.cfsan.fda.gov/~ear/milksafe/milksa61.htm



Although there does not appear to be any current literature substantiating the claim that pasteurization directly damages the bioavailability of the calcium within it, it should be kept in mind that pasteurization is only one of several important quality issues. High-quality milk is not only raw but also obtained from cows eating green pasture grown on rich soil. The fat-soluble vitamins and other nutrients in grass are important to calcium utilization.

Additionally, the network of lactic acid bacteria that is indigenous to milk may favorably influence the intestinal flora of the consumer over an extended period of time. A long-term study might therefore be able to detect differences in calcium status that a short-term study cannot.

Slide 62
http://www.cfsan.fda.gov/~ear/milksafe/milksa62.htm

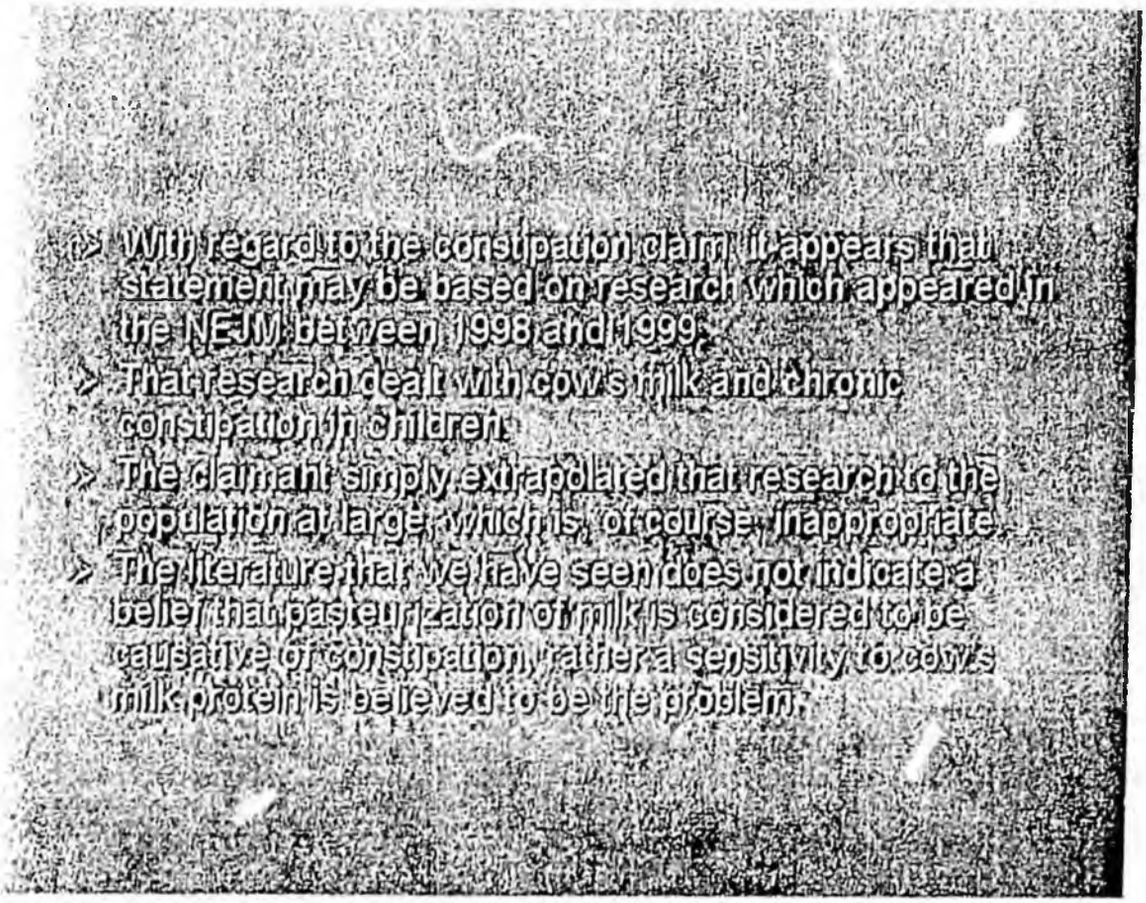


Thus far we have seen that pasteurization of milk causes from 65% to "virtually complete" destruction of its lactoferrin, in conjunction with homogenization destroys 69% of its xanthine oxidase, destroys between 30% and 100% of its lactoperoxidase and lysozyme, destroys its vitamin C activity, and destroys its indigenous network of friendly bacteria that may make the milk more digestible and help prevent the development of allergies. **These are indeed among milk's "most vital qualities."**

The authors of this report cited three earlier studies demonstrating that heating milk causes a 20% loss of iodine and one study showing that spray drying milk causes a 40% loss of iodine.

They noted that their "conclusion is at variance with results of previous workers who reported losses of milk iodine during processing" and stated that "this discrepancy may reflect the difficulty of measuring iodine concentration of milk accurately."

Slide 63
http://www.cfsan.fda.gov/~ear/milksafe/milksa63.htm

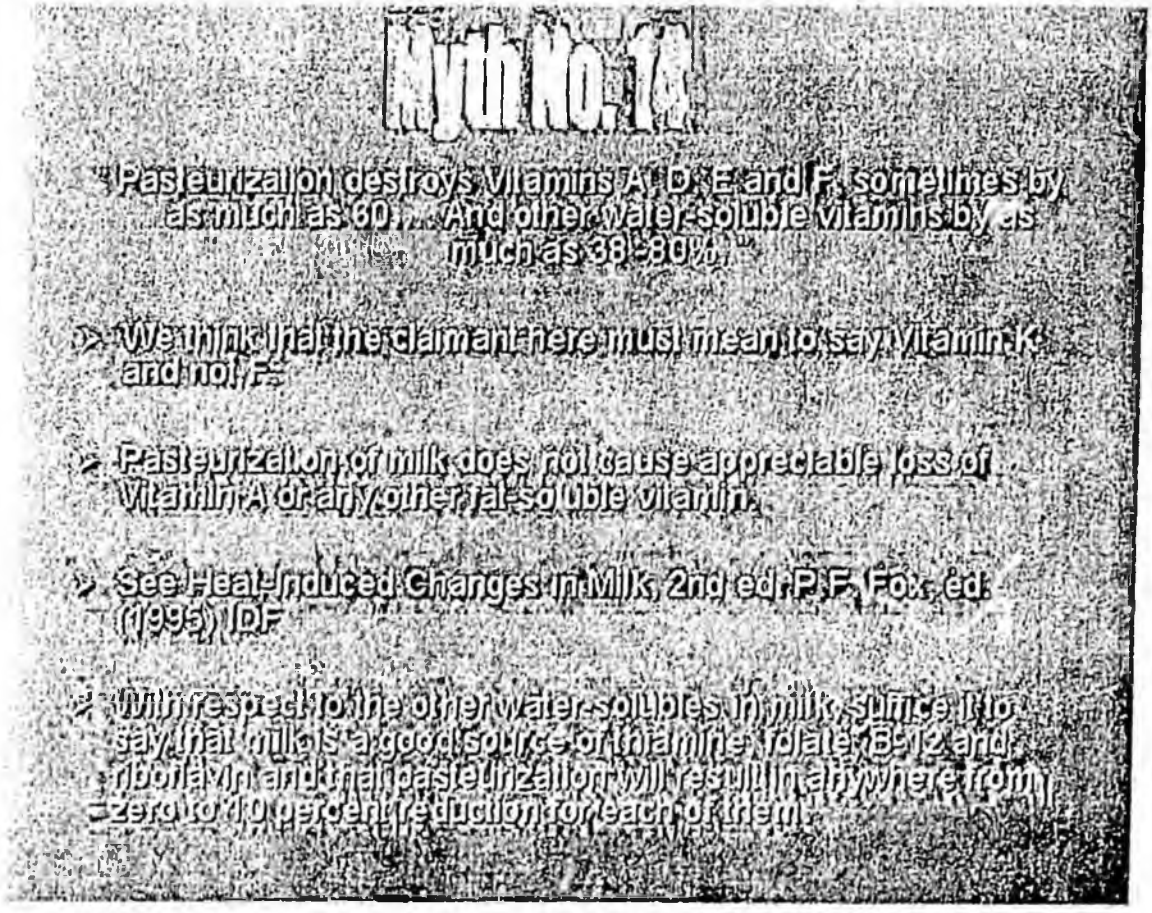


It is doubtful that the author of the 1938 article being quoted had in mind research published between 1998 and 1999, sixty years after the article was published.

A *PubMed* search for "milk constipation" yields 170 results.

Since the FDA does not cite which literature it has seen indicating that pasteurization does not contribute to the relationship between milk and constipation, we cannot address this statement.

Slide 64
http://www.cfsan.fda.gov/~ear/milksafe/milksa64.htm



In the 1930s, when the article being quoted was written, some writers used "vitamin F" to refer to the essential fatty acids.

During this time, scientists often assessed the vitamin contents of foods on the basis of their ability to prevent or cure a deficiency disease when fed to animals.

Although the modern practice of directly measuring the vitamin content is more precise, it does not take into account the effect of heat treatment on the bioavailability of the nutrients. In order to gain an accurate scientific understanding of how pasteurization affects the nutritive value of milk, researchers must study not only the loss of the actual vitamin, but also the loss or alteration of binding proteins that enhance the bioavailability the vitamin as well as the heat-induced formation of compounds that interfere with the vitamin's biological activity.

Until this is achieved, we should give greater weight to the feeding experiments performed in the 1930s. Abstracts of these studies can be found at http://www.realmilk.com/abstractsmilk.html.

Response to Slide 64 Continued

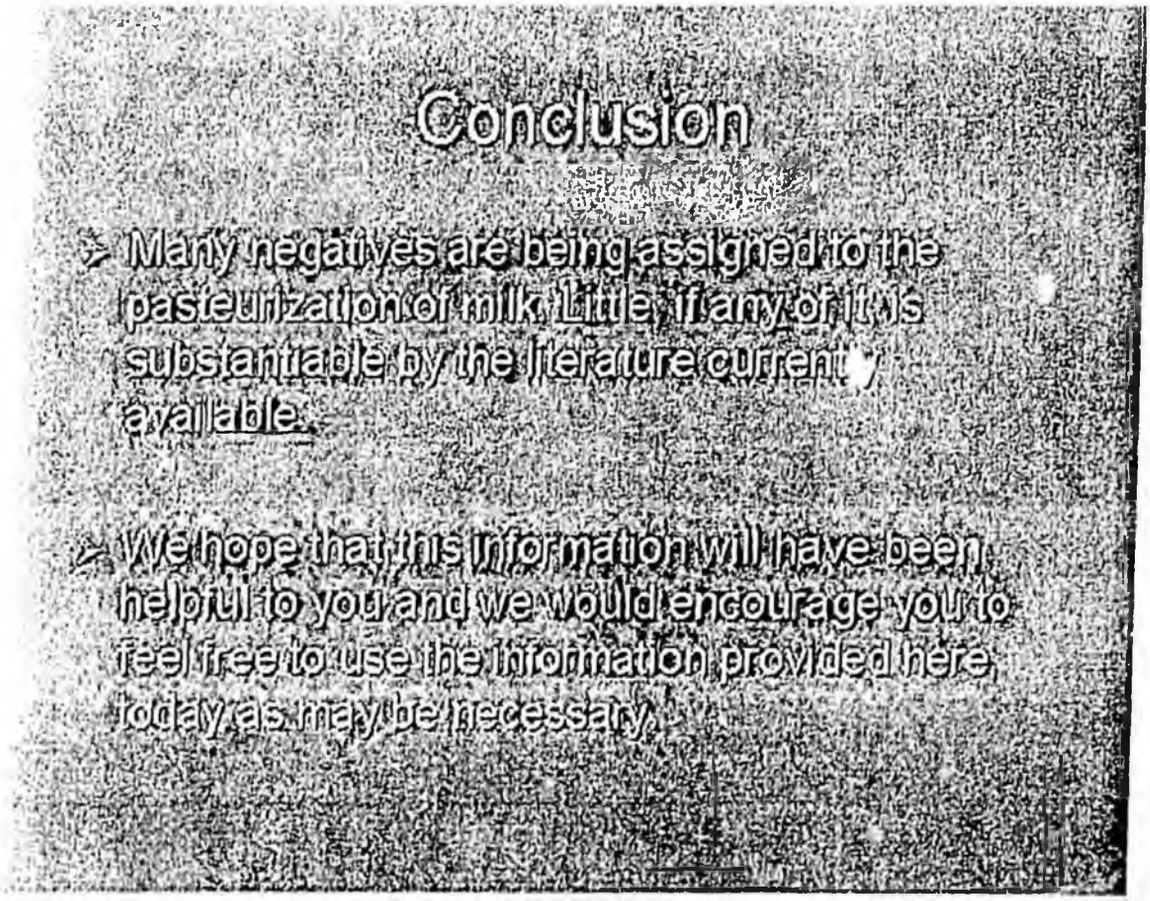
According to the reference cited by the FDA, between 90 and 100% of milk folate is bound by a protein that doubles its intestinal absorption. This protein is inactivated by pasteurization. Vitamin B_{12} is also bound by heat-sensitive proteins whose functions are unknown.

Vitamin B_6 that has been damaged by heat interferes with the activity of the intact vitamin and aggravates the symptoms of its deficiency.

Beta-lactoglobulin, a heat-sensitive protein in milk, increases the intestinal absorption of vitamin A. Vitamin D is also present in milk in a protein-bound form, but the effects of pasteurization on the protein and the effect of the protein on the bioavailability of the vitamin are unknown.

There are likely many other factors affecting nutrient bioavailability that are altered by pasteurization.

Slide 65
http://www.cfsan.fda.gov/~ear/milksafe/milksa65.htm



Many of the statements that the FDA calls "myths" are in fact clearly demonstrated in the scientific literature. Other such statements are poorly formulated but refer to something that is nevertheless true and important. While a few of the assertions may be unsubstantiated, the fact is that **there exists an overwhelming set of observations recorded in the scientific literature justifying interest in the benefits of raw milk.**

There exist many more anecdotal reports of potential benefits that the scientific establishment has not yet addressed. Consumers, however, should not be at the mercy of funding institutions that control which of these issues are researched; they should have the right to put into their bodies the milk of their own choosing.

Our federal and state governments, for their part, should be helping farmers produce raw milk safely, and **the FDA should be providing us with a sober and balanced report on the safety and merits of raw milk rather than a piece of sensationalist propaganda.**

: 02/16/08

FRESH MILK

We the people of the State of Alaska do petition our elected representatives to support legislation that will make the selling and buying of **RAW MILK** free and legal.

Pasteurized and homogenized milk is available to all who wish to purchase it. We who want raw milk should have the same option.

	Name	Address	Phone #	Date
1	[illegible]	109 Arbonte	451-7432	02/16/08
	Michael Shepard	Fairbanks AK		
2	Mark Colson	North Pole Ak.	451-5570	2/19/08
	Angela Holland	1477 Lemee Way N.Ak	488-2486	2-33-0[illegible]
3	Josie Imus	FBKS AK	374-3364	2/19/08
4	Zach Fern	FBKS, AK	488-1024	2/19/08
5	Paula Vrana	Wasilla AK	357-3118	2/23/08
	JULIE WILKERSON	HEALY AK	(683 1207	2/23/08
6	Carole BESNICK	FBKS AK	479-1255	2/24/[illegible]
	CRAIG GERLACH	FBKS, AK	488-5789; 474752	3/1/08
7	Steven Olson	North Pole AK	488-2500, 388-0162	
	Shelley Renehan	Fairbanks AK	389-1911	3-7-08
8	Kathy Sorenson	Tok AK		3/4/08
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	Name	Address	Phone #	Date
1	Kristen Nabinger	309 Beechwood St Folks AK 99712	488-1603	3/18/08
2	Rusty Switcher	1253 Sutton Loop		3-18-08
	Peter Knight	2232 B Soker Ave		3/19/08
3		FBX 99709		
	Qiaw Ling	2325-30th Ave. Fbks 99701	452-5538	3/19/08
4	Collette M. Kissdmar	721 Eastside Dr. Fbks AK	456-3019	
5	Lorraine Chambers	2070 Terry Ln North Pole AK 99705	488 3021	19 Mar 08
6	Mary Ct Kemp	2580 Smiley Ln. N.P.		3/19/08
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	Name	Address	Phone #	Date
1	Joeleen Hill		N/A	3/07/08
	Chris Pelzer		451-5372	3/7/08
2	Jamie Silkworth		N/A	3.8.08
	Kathie Gettinger		474-9245	3/12/08
3	Grennell J. Hisamoto		978-6266	3.8.08
	Dawn Partyka		455-7728	3/10/08
4	Molly Bennett		460-4679	3/10/08
	Emma Rubin		457-2820	3/11/08
5	Ann Bell		451-4536	3/11/08
	Margaret DeSpain		378-2847	3/18/08
6	Carolie Pick	2410 Boardwalk St	456-2743	3/11/08
	Ginger E. Meta	1066 Smallwood Dr	488-3932	3/11/08
7	Edna Johanson	589 Mad Russian St	458-8932	3/12/08
	Victor Johanson	589 Mad Russian St	458-8932	3/12/08
8	Carrie Farr	Box 4 Nenana	832-1056	3/12/08
9	Liz Christian		727 0451	3/13/08
10	Amanda Stewart		590 7853	3/13/08
	Sherry Byers	PO Box 82[illegible]	374-1940	3/13/08
11	Phyllis Krog	3514 W Wood	Fairbanks AK 99709	UP AK 99705 488-3326
	[illegible]	1452 Bonanza Ave	FBKS 99709	799-1426
12	Jeanne Watson	P.O. Box 83906	590-3797	3-14-08
	Teresa Long	5220 Kristin Dr	488-5335	3/14/08
13	Leon Kotsch	3350 Thomas St #161	378-5593	3/14/08

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	Name	Address	Phone #	Date
1	MARY KOPF	FBKS, AK 99701 410 TRAINOR GATE	(907)456-5433	2-28-08
2	Misty Mallory	824 Sheep Creek Rd	374-3083	2-28-08
3	Nina Heagney	407 Ketchikan AVE.	455-9018	2-28-08
4	John Harding	146 Hunt Ct Fairbanks 99709	479-5646	2-28-08
5	LINDA FERGUSON	1344 Gold Rush Dr. 99709	DAY 474-7203 [illegible]	2-29-08
6	SHARROK LARISA	PO 1375 Delta Jct. 99737	5787450	2-29-08
7	Finley Bock	PO Box 38 Nenana AK 99760	(907) 832-3463	Feb. 29, 2008
8	Laura Hatton	PO Box 305 Kasilof, AK 99610	907 398-4774	2-29-08
9	Tamara Phillips	359 Miller Hill Rd #9 Fairbanks, AK 99709	907 457-2926	2-29-08
10	NANA PAOLI	PO Box 70454 FBKS, AK 99707	907.479-3407	2.29.08
11	Lesli Rulz	2395 Badger Rd North Pole, AK 99705	(907) 978-0812	2-29-08
12	Gerald Reau	2395 Badger Rd. Apt Up North Pole, AK 99705	(907) 488-5058	2-29-08
13	Cat Whitney	P.O. Box 82310 Fbx AK 99708-2316	(907) 457-1980	

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	Name	Address	Phone #	Date
1	KOPF, BRIAN	PO Box 71852	907-460-6684	2/19/08
	~~Frank & Dottie Daniels~~	~~PO Box 55382 NPAK~~	~~488-3544~~	~~2/19/08~~
2	Candace Mast	2021 Badger Rd.	907-322-5578	2/19/08
	Mari Saltstrom	P.O. Box 60235, FBKS. Ak	479-4813	2/19/08
3	Karin Franzen	3888 Reynolds Lane, Fbks, AK 99712	488-7641	2/19/08
	~~Jim Gowers JR~~	~~1196 S. CROWN RD. FBKS, 99709~~	~~457-5826~~	~~2/19/08~~
4	DIANA LAUER	3339 SATURN WAY	No Pole AK	2/19/08
	Randi Montgomery	PO 70887 Fairbanks, AK	451-1814	2/20/08
5	Anna Gibson	PO 96543	North Pole 99705	
	Tom Rasmussen	376 Kaufman Lane	Fairbanks, AK 99712	488-0526 2/21/08
6	Rebecca Johnson	PO Box 81466	Fairbanks, AK 99708	451-0113 2/21/08
	George P. Redhead	1942 Perkins Dr.	" " 99709	474-3737
7	Jake Pinnell-Stephens	3140 Parkwood Ln. Fby	99709	479-5826 2/19
	~~Jacqueline C. Beck~~	67520 old Richardson, Seldovia	99714	480-8253
8	Breeden Stevenson	North Pole, AK		
	IAN HERRERA	Fairbanks, AK	sdaris@alaska.net	
9	ANDREW BARKER	930 WINDFLOWER LANE	FBKS 99712	
	Estellita Bayly	3917 Sacco Dr. North Pole, AK 99705	490-0029	21 Feb 2008
10	Chris Murphy	903 Leuhold Dr	Fbks, AK 99712	
	Michael Canady	735 Tanana St L30 FAIRBANKS AK 99701	907-458-7080	2/21/08
11	Kim Sanders	PO Box 10302	FBKS AK 99710	2/22/08
	Lisa Del Alba	1227 Chena Ridge Rd.	455-4676 (907)	2/22/08
12	Peggy & Walter	200 A St, Stop 122,	Clear AK 99704	
	(907) 832-5270			2/22/08
13	Bonnie Harling	1516 Gilbam Way		2/20/08

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	Name	Address	Phone #	Date
1	Danielle Chace	4495 Melan Dr. S.	907-460-7569	02/16/08
2	Jeanie Brooks	PO Box 72406		12/16/08
3	DAVID L. NEBERT	862 REDPOLL LN FBKS 99712	907-457-1670	12/16/08
4	Joseph G. Russo	PO Box 80794, FBKS, AK 99708	488-4825	16 FEB 08
5	[illegible]	P.O. BOX 80934, FBKS, AK 99708		
6	Kate Johnson	410 Trainor Gate Rd, Fbks AK 99701		2/18/08
7	Lori Lange	260 Fair Pl. FBKS	479-6192	2/18/08
8	Mary P. Stech	Box 81169 Fbks, AK 99708	479-0404	2/18/08
9	Kristi Dunlap	POB 80943 Fbks AK 99708	479-6547	2/18/08
10	Clarence Baysinger	POB 1208 Delta Jct AK 99737		
11	Tiffany Gibson	1311 Monna Way North Pole AK 99705	488-1020	18 Feb 08
12	[illegible]	[illegible]	[illegible]	
13	[illegible]	1625 [illegible] FBKS 99709		19 Feb 08

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	Name	Address	Phone #	Date
1	Gary Johnson	4107 Trainor Gate Rd. Fbks, AK. 99701		2/22
2	Bonnie Larsen			2/24
3	Sandi Trumbower	PO Box 3185 Anderson AK 99704		2/24
4	April Barnes	PO Box 81863 Fairbanks		2/23
5	Alisa Williams	PO Box 81466 Fairbanks, AK 99708		2/23
6	Col Schellhaas	Po Box 55459 North Pole AK 99705		2/26
7	Amanda McCabb	Po Box 366	Healy, AK 99743	2/26
8	Emily Bathory	1215 Bunnell #24	Fairbanks, AK 99701	2/26
9	Francine Kazenoff	Po Box 148	Po Esters, AK 99725	2/27
10	Karen Vernon	PO Box 140035	Salcha, AK 99714	2/28
11	Gary Morrison	Box 61583	Fbks. AK 99706	2-27-08
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	Name	Address	Phone #	Date
1	Rhoda McNabb	P.O. Box 642	(907) 895-1635	2/18/08
	Rhoda McNabb	Delta Jct	(907) 460-8062	2/16/08
2	Penny Gauntt	HC60 Box 4263-1	(907) 322-3883	2/20/08
3	Lloyd Wilhelm		(907) 895-4058	2/20/08
	PO Box 1182	Delta Junction	99737	
4	Abigail Brennan			2-20-08
	Barbara Parker		(907) 895-1032	2-20-08
5	PO Box 1035	Delta Junction	99737	
	Lisa Nabb	P.O Box 1639	Delta 895-5525	2-20-08
6	Patrick Kropel			
	PO Box 963	Delta Jct	895-5182	2-20-08
7	Paul Anderson		895-4181	2-20-08
	P.O. Box 985			
8	Nicole Facko		895-4274	2-20-08
	Ryan Walters		590-1496	
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	Name	Address	Phone #	Date
1	Jerry J Stephens	2088 Levando Ave	488-9177	2/16/08
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	Name	Address	Phone #	Date
1	Jesse Brennan	PO Box 1165 Delta	895-5553	2/15/08
	[illegible]	PO Box 1165 Delta	895-5553	2/15/08
2	JACOB BRENNAN	PO Box 1656 DELTA JCT, AK		99737
3	[signature]	POB 1581 Delta Jct	99737	895-4240 2-17-08
4	[illegible]	POB 1581 Delta Jct AK	99737	
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