



## Where next with Johnes?

Ontario Association of Bovine Practitioners

Michael T. Collins, DVM, PhD, DACVM  
Professor of Microbiology  
University of Wisconsin-Madison

## Food Safety News

*Breaking news for everyone's consumption*

Home | Foodborne Illness Outbreaks | Food Recalls | Food Politics | Events | Subscribe | About Us

### Food Safety Top Concern for Canadians

*E. coli seen as biggest threat more than a month after XL recall*

BY NEWS DESK | JANUARY 2, 2013

The safety of the food supply is a leading concern for Canadians, according to a survey conducted more than a month after XL Foods recalled 1.5 million pounds of beef products sold in the country for potential E. coli contamination.

The XL beef was eventually linked to 18 E. coli O157:H7 illnesses that occurred between September and October of 2012.



Now, the results of a survey taken between November 20 and 22 of last year show that food safety is nearly on par with reducing the federal deficit as an issue of importance to Canadians. Out of the 1,000 people surveyed, 78 percent said reducing the deficit was important, while 75 percent said ensuring the nation's food supply was important.

## Food Safety News

*Breaking news for everyone's consumption*

Home | Foodborne Illness Outbreaks | Food Recalls | Food Politics | Events | Subscribe | About Us

### Gort's Gouda Raw Cheese Outbreak Sickens 21 with E. Coli, One Dead

BY NEWS DESK | SEPTEMBER 24, 2013

At least 21 people have now fallen ill with E. coli O157:H7 after eating raw cheese products made by Gort's Gouda Cheese Farm in Salmon Arm, B.C.

One elderly victim died in August, while others developed symptoms between late July and September.

The number ill by province is as follows:

Alberta (9 illnesses), British Columbia (9), Manitoba (1), Quebec (1), Saskatchewan (1).



Symptoms of E. coli infection include diarrhea, vomiting, and stomach cramps lasting five to ten days. Severe

## Food Safety News

*Breaking news for everyone's consumption*

Home | Foodborne Illness Outbreaks | Food Recalls | Food Politics | Events | Subscribe | About Us

### Costco Recalls Organic Ground Beef in Canada for E. Coli Contamination

BY NEWS DESK | OCTOBER 12, 2013

The Canadian Food Inspection Agency (CFIA) and Costco Wholesale Canada announced yesterday that Costco was recalling its Kirkland Signature brand Organic Lean Ground Beef for potential E. coli contamination.

Kirkland Signature Organic Ground Beef with a UPC code of 4 00000 91873 0 with a Best Before Date of 13-OC-15 was sold at Costco warehouses in British Columbia, Alberta, Manitoba and Saskatchewan.

According to CFIA, there have been no reported illnesses associated with the consumption of the ground beef. Costco Wholesale is voluntarily recalling the affected product from the marketplace. CFIA is monitoring the effectiveness of the recall.



## Food Safety News

*Breaking news for everyone's consumption*

Home | Foodborne Illness Outbreaks | Food Recalls | Food Politics | Events | Subscribe | About Us

### Canadian Distributor Recalls Beef Products for Possible E. Coli Contamination

BY NEWS DESK | NOVEMBER 19, 2012

The Canadian Food Inspection Agency has announced the recall of two varieties of Viandes Lauzon beef products because of possible E. coli contamination.

The products are Viandes Lauzon Lean Ground Beef and Viandes Lauzon Extra Lean Ground Beef. The Canadian food-safety regulator said that the recall was made by the products' Quebec-based distributor, Groupe Colabor.

**33345** Viandes Lauzon  
UNE DIVISION DE COLABOR  
2715, READING, MONTRÉAL, PQ H1P 1P7

**BOEUF HACHÉ EXTRA MAIGRE**  
**EXTRA LEAN GROUND BEEF**

Provenance: Parties fraîches et congelées  
Made from: Fresh and frozen parts

GARDER AU FROID | 2 x 2.5 kg | 1211113  
KEEP REFRIGERATED | POIDS NET WEIGHT

(01) X22679433345X (1) 131112 3102 025 02 (2) 000033345

The beef products have been sold to hotels, restaurants, institutions and daycare facilities

## Food Safety News

*Breaking news for everyone's consumption*

Home | Foodborne Illness Outbreaks | Food Recalls | Food Politics | Events | Subscribe | About Us

### Study Links Bacteria in Processed Chickens to Contamination on Farm


BY GRETCHEN GOETZ | JUNE 15, 2013

The levels of bacteria in broiler chickens at the processing plant appears to be related to the amount of bacteria found among birds on the farm, according to a new study.

Researchers at the University of Georgia, Athens looked at the prevalence and loads of Salmonella and Campylobacter in 55 flocks at a large chicken farm in Georgia and found that high levels of these bacteria on the farm corresponded to high levels on carcasses at the processing plant.


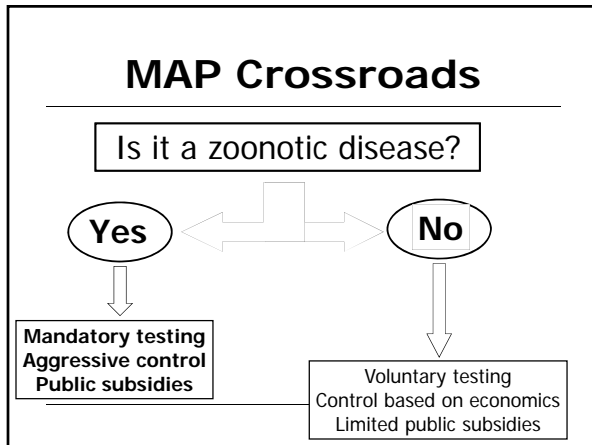
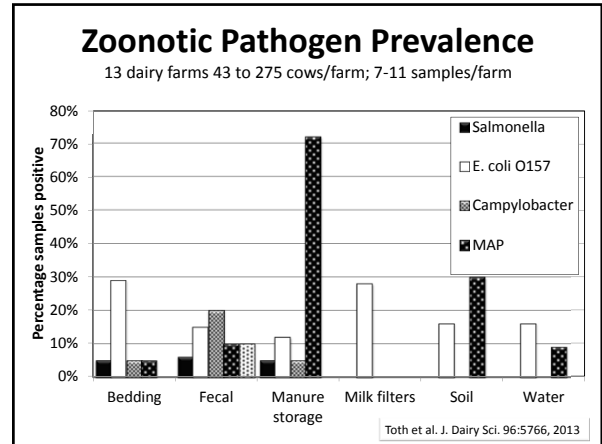


Most cases of Campylobacter infection in the U.S. are associated with eating raw or undercooked poultry, according to the Centers for Disease Control and Prevention.


 J. Dairy Sci. 96:5756–5761  
<http://dx.doi.org/10.3168/jds.2012-6499>  
 © American Dairy Science Association®, 2013.

**Short communication: Survey of animal-borne pathogens in the farm environment of 13 dairy operations**



J. D. Toth,<sup>\*†</sup> H. W. Aceto,<sup>\*</sup> S. C. Rankin,<sup>†</sup> and Z. Dou<sup>\*</sup>  
<sup>\*</sup>Department of Clinical Studies, and  
<sup>†</sup>Department of Pathobiology, School of Veterinary Medicine, University of Pennsylvania, Kennett Square 19348

### Is MAP a zoonotic pathogen? Murder Metaphor

Did the accused have the:

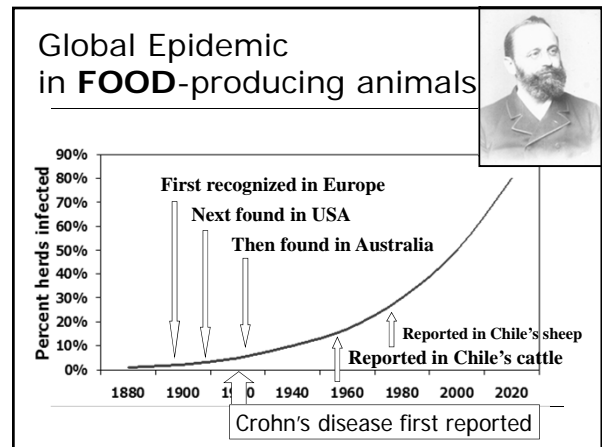
- ✓ The opportunity
- ✓ A motive
- ✓ The means

You be the judge

Where's the "smoking gun":

- ✓ Forensic evidence





## MAP in powdered infant milk formula?



Botsaris et al. 11-ICP  
 35 samples; 11 producers  
 9.4% MAP culture-positive  
 21.9% PCR-positive

United Kingdom	45 <sup>b</sup>	24	2.2?	Grant and Thompson (MS thesis)
----------------	-----------------	----	------	--------------------------------

<sup>a</sup> from 10 producers operating in 7 EU countries  
<sup>b</sup> from 6 producers, all UK-based except one

? Suspect cultures were PCR-positive but failed to grow on subculture.

Epidemiologic studies report that breast feeding lowers risk of Crohn's disease.



## Pasteurization is not 100% Effective

### MAP: cultured from retail pasteurized milk

- 1.8% in U.K. (Appl. Env. Microbiol. May, 2002)
- 1.6% in Czech Rep. (AEM March, 2005)
- 2.8% in U.S. (J. Food. Protect. May, 2005)
- 67% in India (Int. J. Infect. Dis. Feb., 2010)
- 2.7% in Brazil (J. Dairy Sci., 2012)
- 2.9% in Argentina (Brazilian J. Microbiol., 2012)



OPEN ACCESS Freely available online PLOS ONE

### Identification and Characterization of a Spore-Like Morphotype in Chronically Starved *Mycobacterium avium* Subsp. *Paratuberculosis* Cultures

Elise A. Lamont<sup>1</sup>, John P. Bannantine<sup>2</sup>, Anibal Armbrín<sup>3</sup>, Don Sanjiv Ariyakumar<sup>4</sup>, Srinand Sreevatsan<sup>1,2,4</sup>

7565

Ben

Linda

**Figure 4. Sporulation occurs in multiple MAP strains.**


Institute for Dairy Chemistry and Technology  
of the  
Federal Dairy Research Centre  
Kiel, Germany

Bundesanstalt für Milchwissenschaft

International Dairy Federation BAFM  
Federal Dairy Research Centre

**Workshop on**  
**Revisiting Heat Resistance of Microorganisms in Milk**  
05-08 May 2003, Kiel (D)

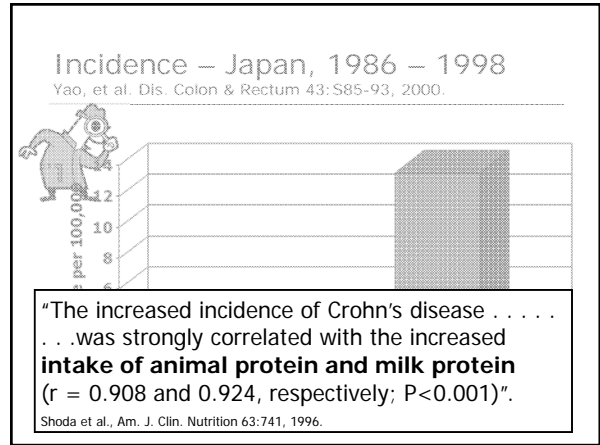
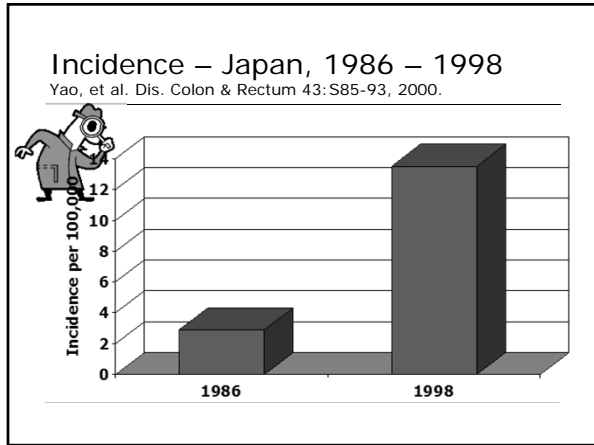
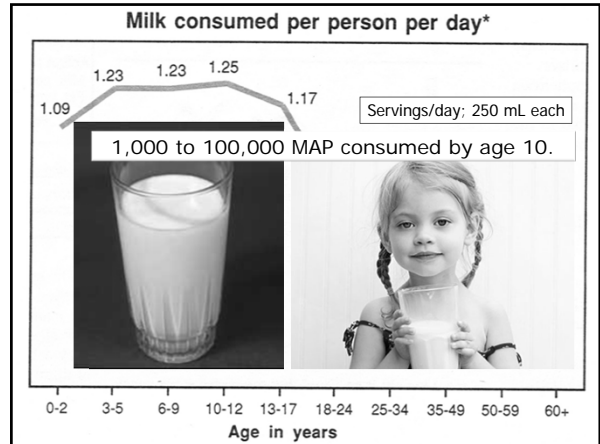
## KIELER MILCHWIRTSCHAFTLICHE FORSCHUNGSBERICHTE




Veröffentlichung der Bundesanstalt für Milchwirtschaft, Kiel

Estimated survival of 1 CFU MAP per liter of retail milk  
(CFU could be 1 *MAP* or a clump of 100 *MAP*)  
MAP survived up to 90 C x 60 seconds  
(pasteurization is 72 C x 15 seconds)

Heat resistance of *Mycobacterium avium ssp. paratuberculosis*  
in raw milk tested in a pilot plant pasteurizer





### Microbiological characterisation of artisanal farmhouse cheeses manufactured in Scotland

ALAN G WILLIAMS\* and SUSAN E WITHERS  
Department of Biological and Biomedical Sciences, Glasgow Caledonian University, Glasgow G4 0BA, Scotland

August, 2010

Twenty-eight Scottish artisanal farmhouse cheeses were examined in respect of 16 microbial groups of significance for food safety and cheese character development. Microbial populations were diverse and although *Escherichia coli* O157 and *Salmonella* spp. were not detected the occurrence of potential food-borne pathogens was confirmed in 86% of the samples analysed. *Mycobacterium avium* subsp. *paratuberculosis* was detected in 25% of the cheeses tested and some *Staphylococcus aureus* and the *Bacillus cereus* isolates were enterotoxigenic. Resistance to methicillin and vancomycin and other clinically important antibiotics was detected in some *S. aureus* and *Enterococcus* strains. The inappropriate labelling of some raw milk cheeses and the consequences of the complexity of the microbial population on isolation media specificity is discussed.

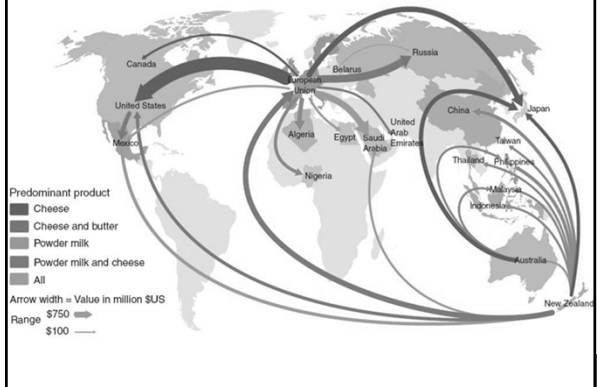
MAP detected by culture  
in 25% of cheeses tested.

\**Mycobacterium avium* subsp.

## Dairy Products are Mobile



Major Global Trade Flows of Dairy Products in 2003



Fonterra Co-operative Group Ltd is a multinational dairy company, owned by 13,000 New Zealand dairy farmers.

It is the world's largest exporter of dairy products, exporting 95% of its production. Its global supply chain encompasses its shareholders' farms in New Zealand through to customers and consumers in 140 countries. Collecting over 13b litres of milk a year, it manufactures and markets over 2m tonnes of dairy products annually, making it the world's leader in large-scale milk procurement, processing and management. Its ingredients business is the largest dairy ingredients operation in the world, manufacturing and marketing more than 1,000 ingredient products to the international food industry under the NZMP brand.



Fonterra receives confirmation of *Clostridium botulinum* in WPC80 samples from AgResearch.



Sunday, August 4, 2013

Danone, which made infant formula in NZ & China.  
Vitaco, which made NZ sport drinks.  
Fonterra animal feed subsidiary NZAgbiz which made calf milk replacer.  
Maxum, which made Australian animal feed.  
Wahaha, which made a Chinese protein-enriched drink.  
Coca-Cola, which made drinks in NZ & China.



Media conference by Gary Romano. Eight affected customers named.



Sunday, August 28, 2013



False alarm – lab error!

September 6, 2013

**The New Zealand Herald** Search keywords...

National World **Business** Sport Technology Entertainment Life & Style

Business Next Article: Home loan limits to stay Wheeler hand

**Fonterra's suspended execs await fate**

By Ben Chapman-Smith  
3:15 PM Friday Sep 6, 2013

☆ Save f 2 t 2 in 0 3 1 p 0



Brian Gaymer: Shake-up needed in Fonterra boardroom

- The \$15 million mouse
- Fonterra fallout: More senior managers placed on leave
- Milk scare claims first scalp

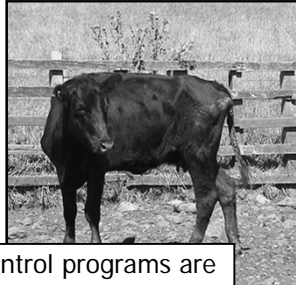
Fonterra's managing director Gary Romano resigned on August 14. Two other senior managers were placed on leave and the Herald understands they are Brent Taylor and Greg Walsh. Photo / Dean Purcell

Related Tags



## Cows With Paratuberculosis are Culled & Consumed

- Pass antemortem veterinary inspection.
- Pass postmortem veterinary inspection.
- Frequently have disseminated MAP infections.



Test-and-cull JD control programs are essentially test-and-feed-to-the-public.

PAPERS & ARTICLES

**Relationships between clinical signs, pathological changes and tissue distribution of *Mycobacterium avium* subspecies *paratuberculosis* in 21 cows from herds affected by Johne's disease**

C. BRADY, D. O'GRADY, F. O'MEARA, J. EGAN, H. BASSETT

Veterinary Record February 2, 2008

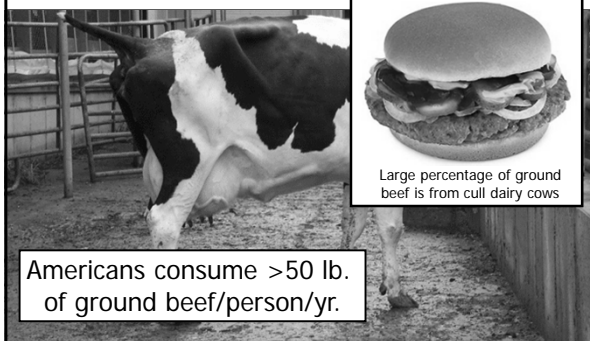
**TABLE 3: Distribution of *Mycobacterium avium* subspecies *paratuberculosis* (MAP) in the 11 pooled samples of tissues from 21 cows from eight herds affected by Johne's disease**

Animal*	Head Lvs	Thoracic organs	Terminal ileum	Mesenteric LN	Ileocaecal LN	Caecal contents	Small intestine	Large intestine	Abdominal organs	Prescapular and popliteal LN	Supramammary LN and mammary gland
A1	+	+	+	+	+	+	+	+	+	+	+
A2	+	+	+	+	+	+	+	+	+	CT	+
A3	+	+	+	+	+	+	+	+	+	+	+
A4	+	-	+	+	-	+	+	+	-	-	-
A5	+	+	NR	+	NR	+	NR	NR	+	-	NR
A6	-	+	+	+	+	+	-	+	-	+	-
A7	+	+	+	+	+	+	+	+	+	-	-
B1	-	+	+	+	+	+	+	+	-	-	-
B2	-	+	+	NR	NR	+	-	-	-	-	-
B3	CT	+	+	+	+	+	+	+	+	+	NR
B4	+	+	+	+	+	CT	+	+	+	+	+
B5	+	+	+	+	+	+	+	+	+	+	+
B6	CT	-	+	-	+	+	+	+	-	-	-
C1	+	+	+	+	+	NR	+	+	+	+	+
C2	+	-	+	+	+	+	NR	+	NR	NR	NR
C3	-	-	-	-	-	-	-	-	-	+	NR
C4	-	-	-	-	-	-	-	-	-	-	-
- ELISA-positive; clinically normal											
D1	+	+	+	+	+	NR	-	+	CT	+	+
D2	-	-	+	+	NR	NR	+	+	-	+	+
D3	-	-	+	-	+	CT	+	+	-	NR	-
D4	+	+	+	+	+	+	+	+	-	+	-

\* Group A Persistent diarrhoea, Group B Intermittent diarrhoea, Group C No diarrhoea but ill-thriven, Group D Clinically normal  
LN Lymph node, + MAP cultured, CT Contaminated, - MAP not cultured, NR No result

## Not all Johne's cows are thin.

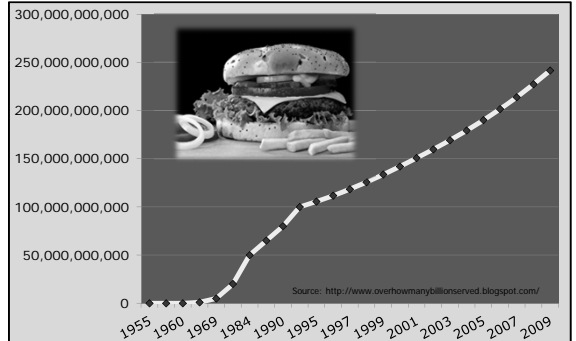
IDEXX ELISA S/P = 2.0



Large percentage of ground beef is from cull dairy cows

Americans consume >50 lb. of ground beef/person/yr.

## Billions and Billions of Burgers!



### Clinical JD in sheep:

59% muscle tissue infected; mean MAP CFU = 1.67 log<sub>10</sub>/gm  
85% peripheral LN infected; mean MAP CFU = 2.06 log<sub>10</sub>/gm

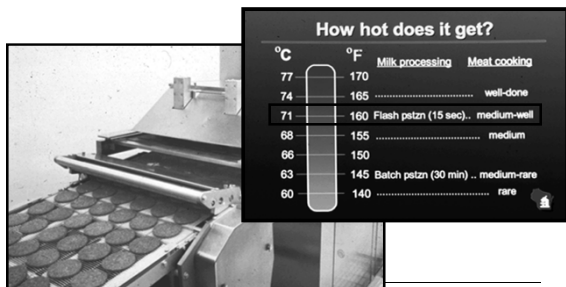
Reddacliff et al. Vet. Microbiol. 145:122-128, 2010

## 8,291 cases of multibacillary paratuberculosis sent into the food supply.

I. Links, 11-ICP



## Will MAP be Killed by Cooking?



## Mycobacterium avium subsp. paratuberculosis in muscle, lymphatic and organ tissues from cows with advanced Johne's disease

L.M. Mutharia<sup>a</sup>, M.D. Klassen<sup>b</sup>, J. Fairles<sup>c</sup>, S. Barbut<sup>d</sup>, C.O. Gill<sup>e,\*</sup>



<sup>a</sup> Department of Molecular and Cellular Biology, University of Guelph, Guelph, Ontario, Canada N1G 2W1  
<sup>b</sup> Canadian Cattlemen's Association, 6715-4th Street NE, Calgary, Alberta, Canada T2E 2H7  
<sup>c</sup> Animal Health Laboratory, University of Guelph, Guelph, Ontario, Canada N1G 2W1  
<sup>d</sup> Department of Food Science and Canadian Research Institute for Food Safety, University of Guelph, Guelph, Ontario, Canada N1G 2W1  
<sup>e</sup> Agriculture and Agri-Food Canada Lacombe Research Centre, 6006 4<sup>th</sup> St E, Trail, Alberta, Canada T8E 2P9

### ARTICLE INFO

Article history:  
Received 14 May 2009  
Received in revised form 20 October 2009  
Accepted 24 October 2009

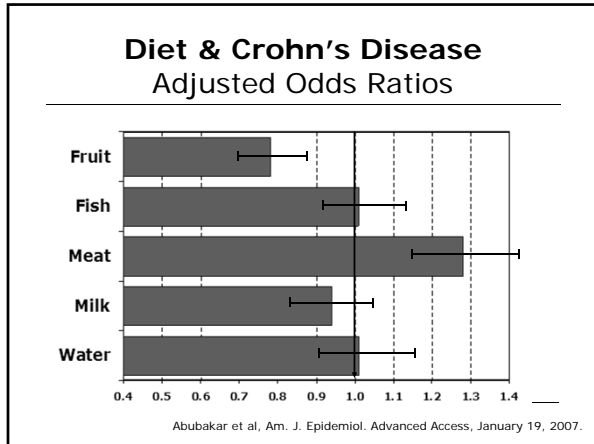
Keywords:  
*Mycobacterium avium* subsp. *paratuberculosis*  
Johne's disease  
lymph nodes  
beef  
Cooking

### ABSTRACT

Blood, liver, kidney, lymph nodes and muscle tissue were obtained from the carcasses of five cows with advanced Johne's disease. Samples from the raw tissues, from cooked muscle tissues and from cooked hamburger patties that contained chopped mesenteric lymph nodes were collected aseptically. Each sample was divided into two portions, one of which was decontaminated. Both portions were homogenized. Homogenates were spread on selective agar for the recovery of *Mycobacterium avium* subsp. *paratuberculosis* (Map) and inoculated into a Map growth medium with the organism being detected in the cultures by PCR procedures and Ziehl-Neelsen staining. Map were recovered at numbers >10<sup>3</sup>cfu/g from 7 of 15 liver and mesenteric and bronchial lymph node samples, and at lower numbers from 5 of 15 kidney and superficial inguinal and pre-carpular lymph node samples. The numbers recovered from decontaminated and not decontaminated portions of each sample were generally similar. Map was recovered from 1 and detected in 6 of 50 not decontaminated portions of samples of raw, chilled or frozen meat; and detected in 1 of 15 not decontaminated samples of meat cooked to 61 °C, and in 1 of 40 samples of meat cooked to ≥70 °C. Map was detected in 2 of 4 samples of mesenteric lymph nodes cooked to 61 °C, but not in samples cooked to ≥70 °C. The findings indicate that Map may be present in meat from infected animals at low numbers, but that any such organisms are likely to be inactivated when meat is cooked to a well done condition.

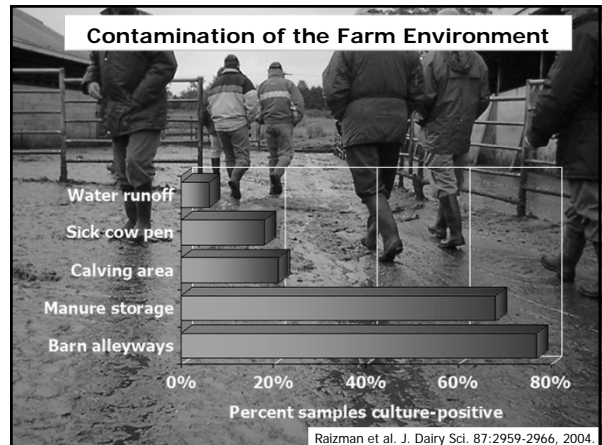
MAP may be present in meat from infected animals at low numbers, but any such organisms are likely to be inactivated when meat is cooked to a well done condition.

L.M. Mutharia et al. / International Journal of Food Microbiology 136 (2010) 340–348



### Clinical Signs

$>10^8$  MAP / gm feces  
 Cows produce ~ 30 Kg feces / day  
 $= 3 \times 10^{12}$  M. paratuberculosis / day  
 $>1$  million infectious doses / day (estimated)



### Cluster of 15 IBD cases in Virginia, USA

Pierce et al. Gut Pathogens 3:20, 2011.

Kids 5 to 18 at onset of IBD:  
 11 kids with CD  
 4 kids with UC  
 All lived adjacent to or near dairy farms



### Cluster of IBD cases in Virginia, USA

Pierce et al. Gut Pathogens 3:20, 2011.

Dairy farms in 1990  
Homes of 15 IBD cases

5/7 kids tested positive for antibody to MAP (p35 & p36 antigens)

of the 15 cases' homes from the 1990-2011 Period, Virginia Inflammatory Bowel Disease outbreak. Note that 5/7 cases reported to only have recently visited 11 farms within 100 miles of their home. 10/15 cases are

### Cluster of IBD cases in Virginia, USA

Pierce et al. Gut Pathogens 3:20, 2011.

Dairy farms in 1990  
Homes of 15 IBD cases

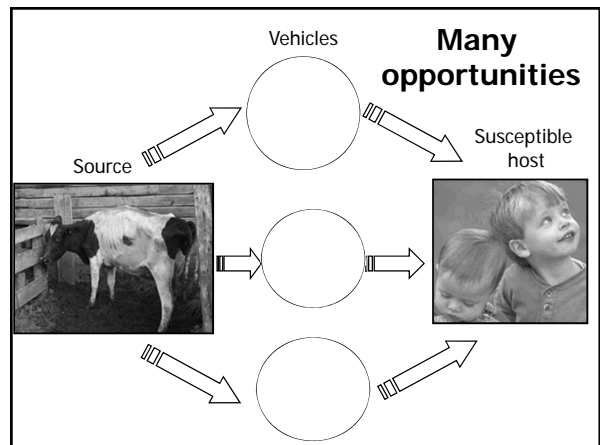
5/7 kids tested positive for antibody to MAP (p35 & p36 antigens)

"This represents an incidence rate of 217 cases per 100,000 children per year; *more than 47 times* the expected rate. We believe an incidence rate 47 times the expected rate **qualifies this cluster as an outbreak**".

### Chlorine Does Not Kill MAP

- MAP: 2 ppm x 30 min only decreased counts 2.8 logs.
  - Whan, Letters in Applied Microbiol. 33:227, 2001.
- "...mycobacteria are 100 to 330 times more resistant to chlorine than *E. coli*."
  - Le Dantec, Appl. Env. Microbiol. 68:1025, March 2002.
- EPA found MAP in 92% of 31 cold water faucets in Ohio at up to 29,000 CFU/L.
  - Beumer et al. US-EPA, Appl. Env. Microbiol. 2010.

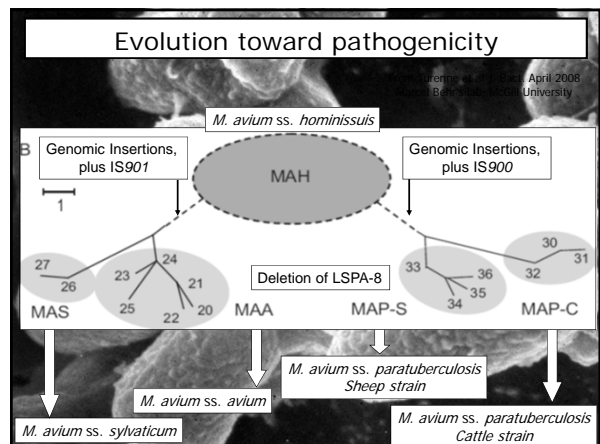
In U.S., mean chlorine exposure 1.1 ppm x 45 min. before 1<sup>st</sup> use in distribution systems.



# MOTI > E

The objective of a bacterium is to become bacteria.

Stanley Falkow



### MAP – Phenotype *in vitro*

Mycobactin-Dependent  
Slow-growing; Colonies in 8-20 weeks

Mycobactin: Iron-chelator synthesized by all mycobacteria except MAP

Fe

MACs: a happy home for MAP  
pH 6.0 & Fe from host transferrin

Life style of an obligate intracellular parasite

### Broad Host Range

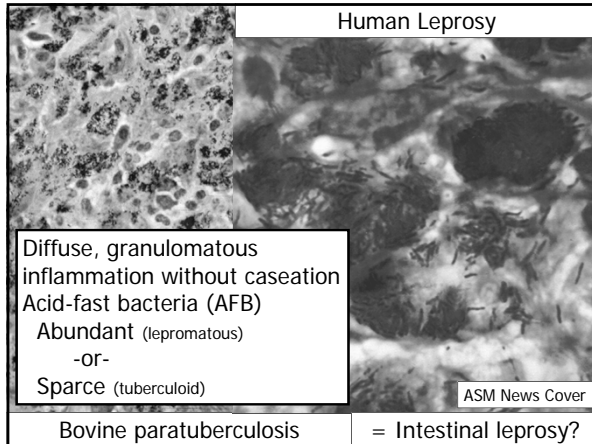
### The means to kill?

MAP is armed to confront the host and, as with other mycobacterial pathogens, eventually wins the battle.

### All Slow-Growing Mycobacteria are Zoonotic

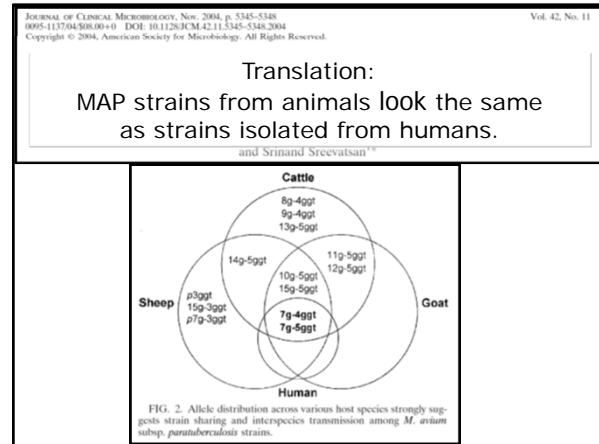
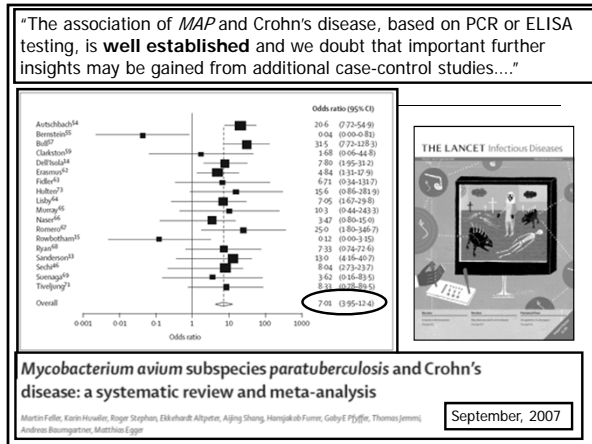
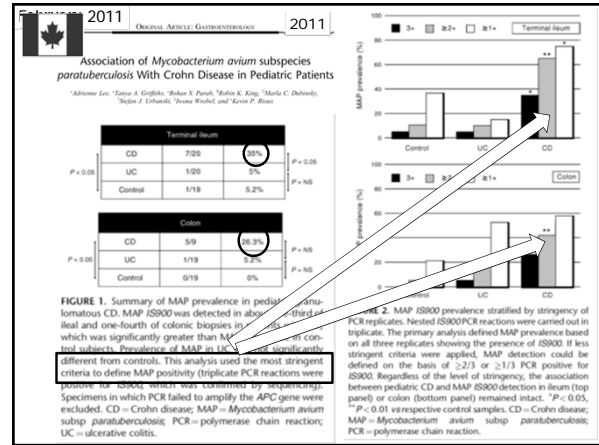
Slower growth = more virulent  
MAP is the slowest growing of all cultivable mycobacteria

Behr, 2008



### MAP controls the host cell... just like *M. tuberculosis*

- Regulates phagosome
  - Sustains pH at growth optimum
  - Selectively allows delivery of molecules like transferrin to phagosome by fusion with vesicles in early endosomal network.
- Suppresses immune response
  - Sequesters itself away from antigen-processing machinery of host cell.
  - Suppress ability of infected macrophage to stimulate CMI.
  - Over-produce cell wall lipids that leave infected cell by exocytosis to suppress neighboring macrophages.

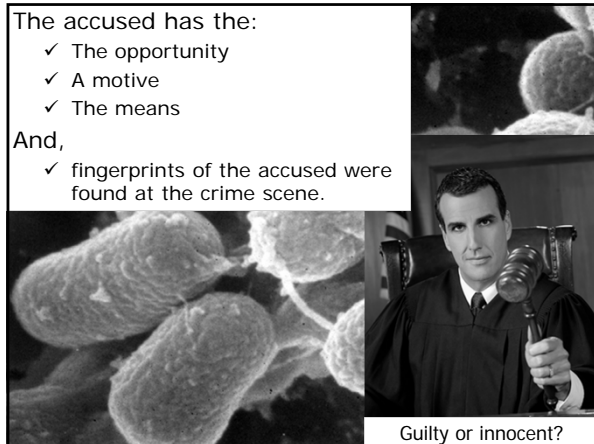


The accused has the:

- ✓ The opportunity
- ✓ A motive
- ✓ The means

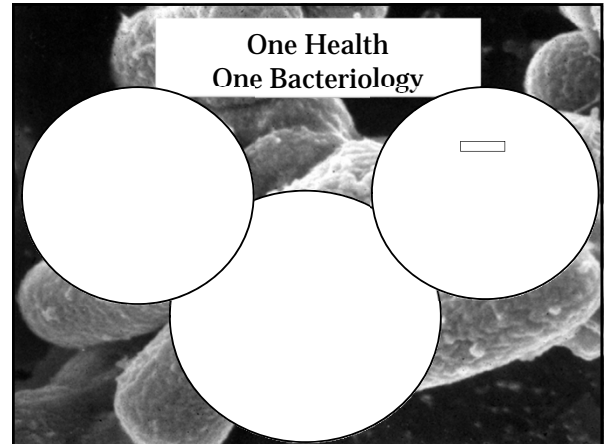
And,

- ✓ fingerprints of the accused were found at the crime scene.




Guilty or innocent?

One Health  
One Bacteriology



### Food For Thought



Ontario has one of the highest rates of childhood-onset IBD in the world, and there is an accelerated increase in incidence in younger children.

**Inflammatory bowel disease**

Increasing incidence of paediatric inflammatory bowel disease in Ontario, Canada: evidence from health administrative data


E I Benchimol,<sup>1,2,3</sup> A Guttmann,<sup>1,3,4</sup> A M Griffiths,<sup>2,4</sup> L Rabeneck,<sup>1,3,5</sup> D R Mack,<sup>6</sup> H Brill,<sup>7</sup> J Howard,<sup>8</sup> J Guan,<sup>1</sup> T To<sup>1,3,9</sup>

Gut 58: 1490, 2009.

**Simple concept:**  
Healthy food comes from healthy animals.

**Simple fact:**  
Animals with paratuberculosis are not healthy.

**Ontario producers and their veterinarians have the knowledge and the tools to deliver raw products with low risk of MAP contamination.**

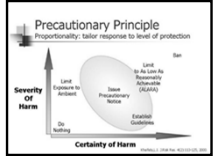


### TAFS

INTERNATIONAL FORUM FOR  
TRANSBOUNDARY ANIMAL DISEASES & FOOD SAFETY


TAFS recommends MAP control at the farm, national, and international level to limit MAP contamination of foods based on the precautionary principle by sourcing raw milk and meat from **test-negative herds**.

<http://www.tseandfoodsafety.org/>



### Countries Capable of Delivering Milk and Beef from Test-Negative Herds

- Sweden
- Denmark
- Netherlands
- Ontario Canada
- Australia
- USA
- Japan



 **Johne's Education & Management Assistance Program**

**Participate and be part of the solution-making process!**

*Receive an \$8.00 per animal reimbursement, whole-herd Johne's test results, and further program assistance.*

Ontario has the most progressive and effective program in the world.

**USE IT!**

**HIGH-TITRE ASSISTANCE**  
Receive \$500 per high-titre animal identified (by a veterinarian).

Working Group  
Recent Publications  
FAQ  
Links  
Home

PROGRAM NEWS


port Contacts





## Advice for OABP:

1. Confirm if each herd in your practice is infected.
2. Make four management changes to limit JD spread.
3. Start a testing program.
  - ❖ Milk ELISA or serum ELISA for commercial herds
  - ❖ Fecal culture or PCR for breeders
4. Act consistently on test results; **trust the tests!**
  - ❖ Cull high-positives before they calve
  - ❖ Label and manage low to medium-positives
5. Prepare to supply milk from test-negative cows.
6. Encourage continuation of the Ontario program.


It's a long journey.....



.....it's easy to drift off course!



**Only with veterinary monitoring does a control program succeed.**



- ✓ **Maternity pens clean?**
- ✓ **Only ELISA-neg cows in pen?**
- ✓ **Culling as planned?**
  - Written protocol
  - No strong positives in fresh cow list
- ✓ **Labeling ELISA-pos cows?**
- ✓ **Colostrum quality & storage?**
  - Written protocols
  - Talk to the person actually doing calf-care
- ✓ **Calf morbidity records?**
- ✓ **Herd infection rate declining?**
  - Review annually

It's a long journey .....stay on course!

