Review of Johne's Disease and Control Strategies

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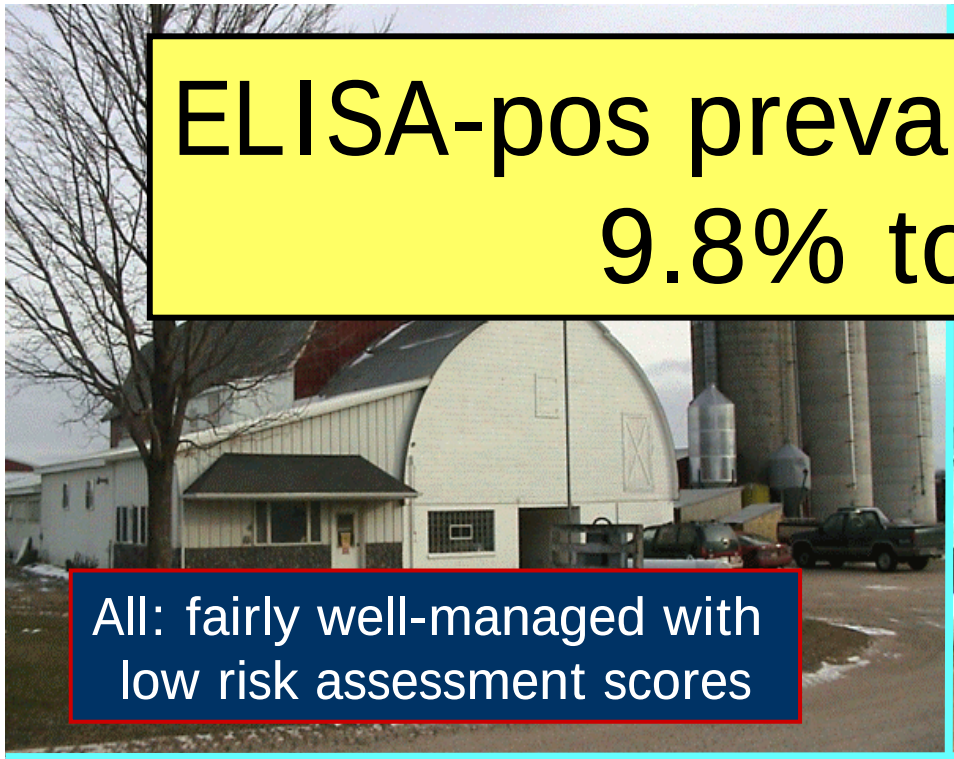
Cost-Effective
JD Control Programs Work!

Study Design

- 9 dairy herds (~4,000 cows) x 6 years
- Compare rate of infection in animals born before and after start of the Johne's disease control program
- Control program:
  - Herd management + herd testing


Diverse Locations

ELISA-pos prevalence at the start
9.8% to 20.9%



Project Program:
Simple, Affordable, Two-Steps

- ✓ **Step #1: Hygiene**
  - Stop new infections: focus on heifer rearing.
- ✓ **Step #2: Testing**
  - **Label** high risk cattle.
    - Segregated calving area
    - Do not use as colostrum donors
  - Cull only the most heavily infected cows – those not likely to survive another lactation.

Step #1:
Just Four Things to Do

1. **Prompt calf removal from cow.**
   While still wet; before standing to nurse.
2. **Feed 4 qt. high quality colostrum in <6hr.**
   One cow to one calf: **from test-negative cow.**
3. **Feed pasteurized milk until weaning.**
   Milk replacer or on-farm pasteurizer.
4. **Hygienic rearing system.**
   Feed and water free from manure contamination.

Step #2:
Test-and-Manage

- ✓ **Test** all cows once in each lactation.
- ✓ **Label** ELISA-positive or “suspect” cows.
- ✓ **Only** use colostrum from ELISA-negative cows.
- ✓ Use **separate maternity pen** for ELISA-negative cows.

Quantitative ELISA Based Management Decisions

S/P	Interp.	Action
< 0.10	Negative	Keep for another lactation
0.10 – 0.25	Suspect	Keep – but do NOT use colostrum
0.25 - 0.40	Low pos	Keep – unless other reasons to cull
0.40 – 1.00	Positive	Cull – unless good reasons to keep
> 1.00	High pos	Cull at dry-off: mandatory
Do not use colostrum or milk from ANY suspect or positive!		

Objective of Testing

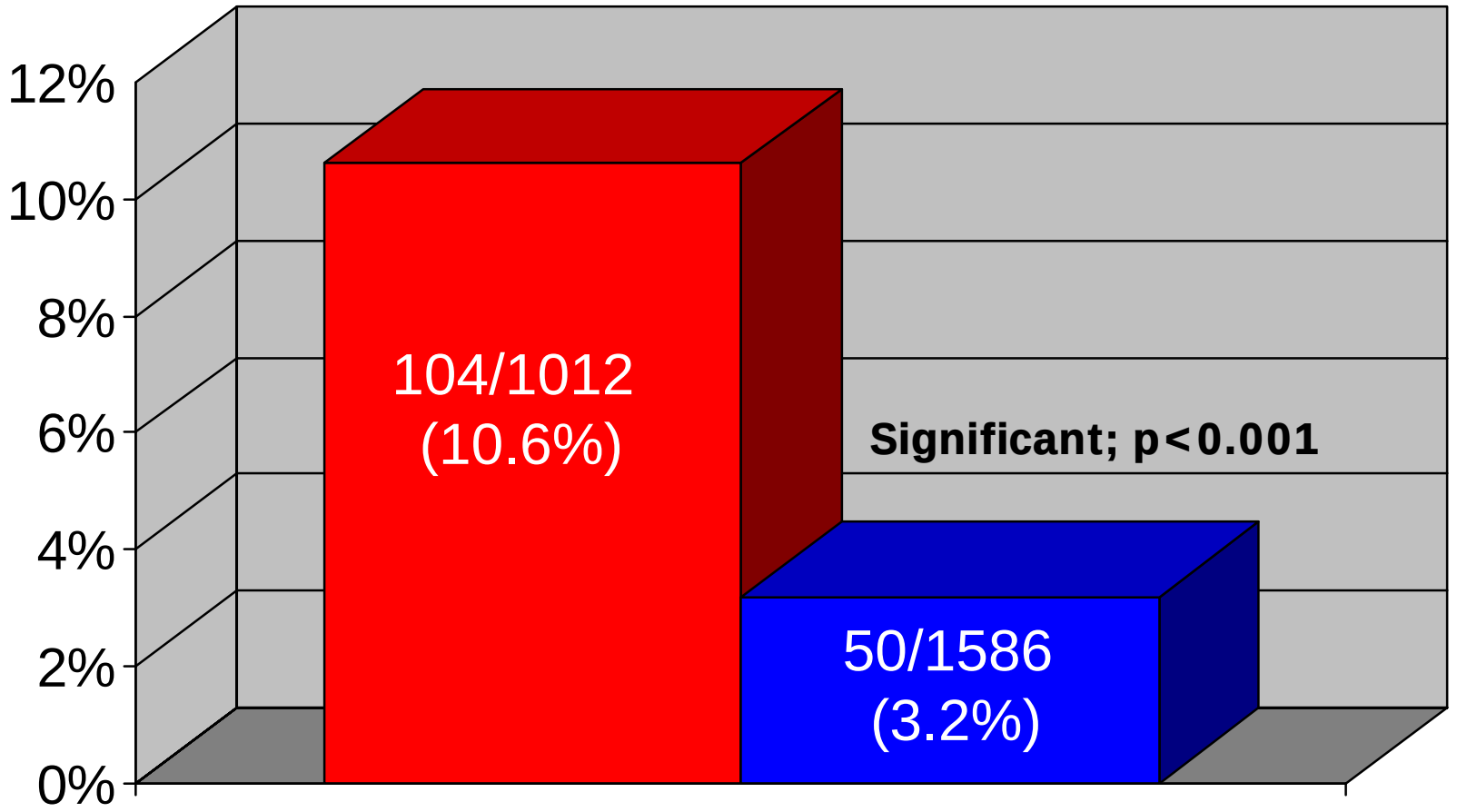
Interrupt transmission from the
MOST infectious to the
MOST susceptible
MOST of the time
("most" refers to probabilities)

Perfect tests are not affordable.
Affordable tests are not perfect.

Before & After Control Program

Percent ELISA-positive

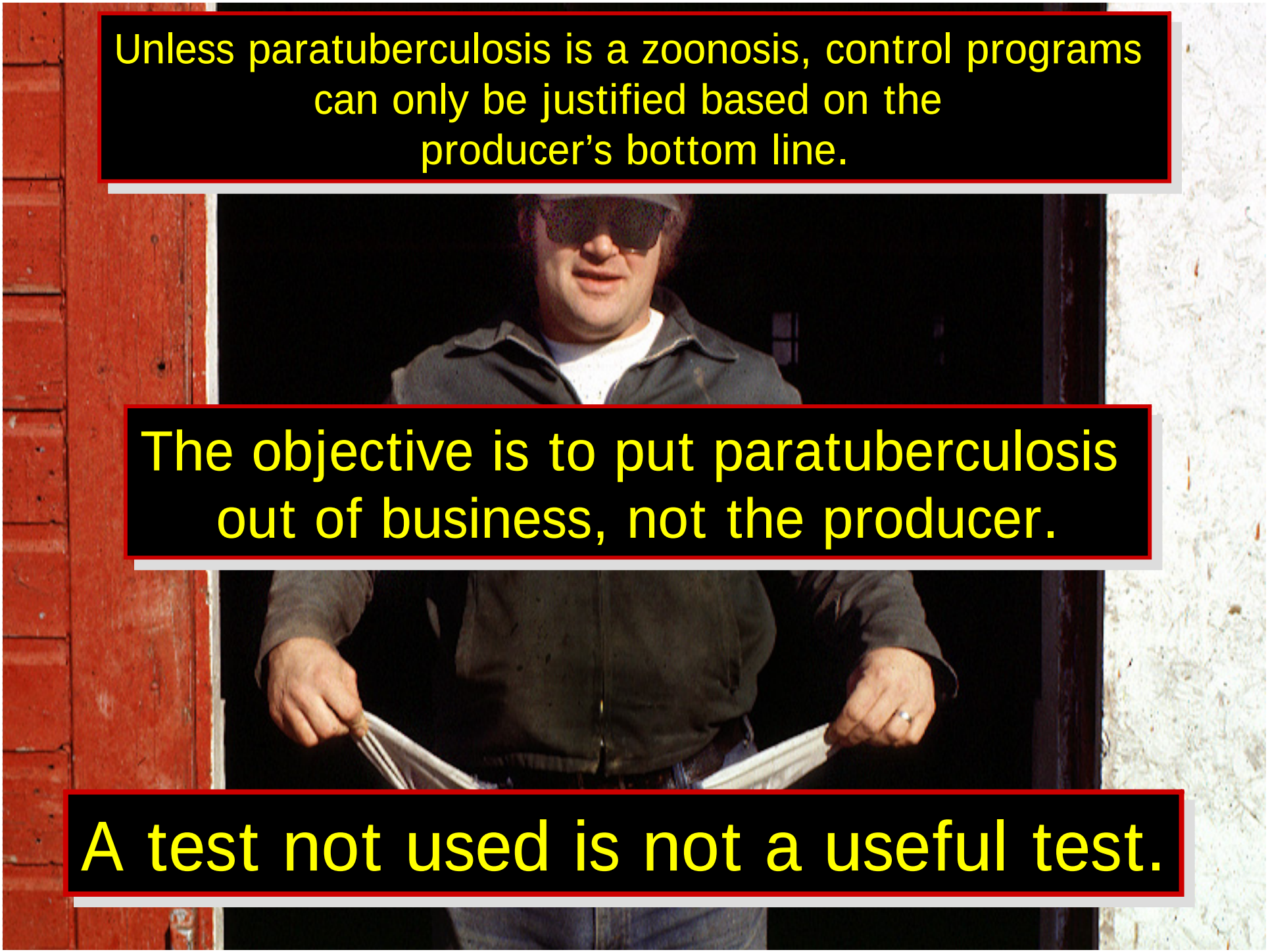
As of January 1, 2007



All herds combined: 1st lactation cows only

Conclusions So Far

- The program is successful
  - Decreased test-positives
  - Stopped clinical cases of Johne's
  - Satisfied dairy producers
- Some herds are controlling Johne's faster than others


Unless paratuberculosis is a zoonosis, control programs can only be justified based on the producer's bottom line.
The objective is to put paratuberculosis out of business, not the producer.
A test not used is not a useful test.

Economic Decision Analysis

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Preventive Veterinary Medicine 75 (2006) 92–122

PREVENTIVE VETERINARY MEDICINE

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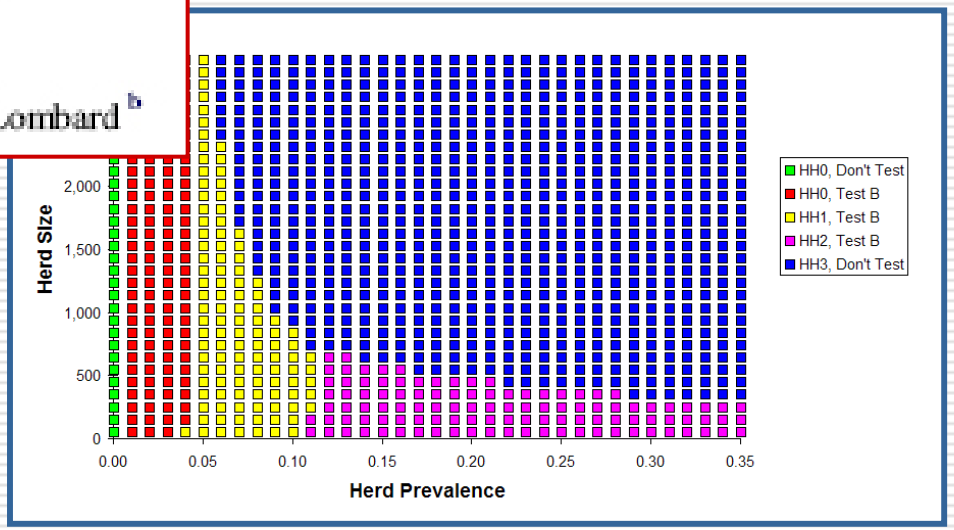
Decision analysis model for paratuberculosis control in commercial dairy herds

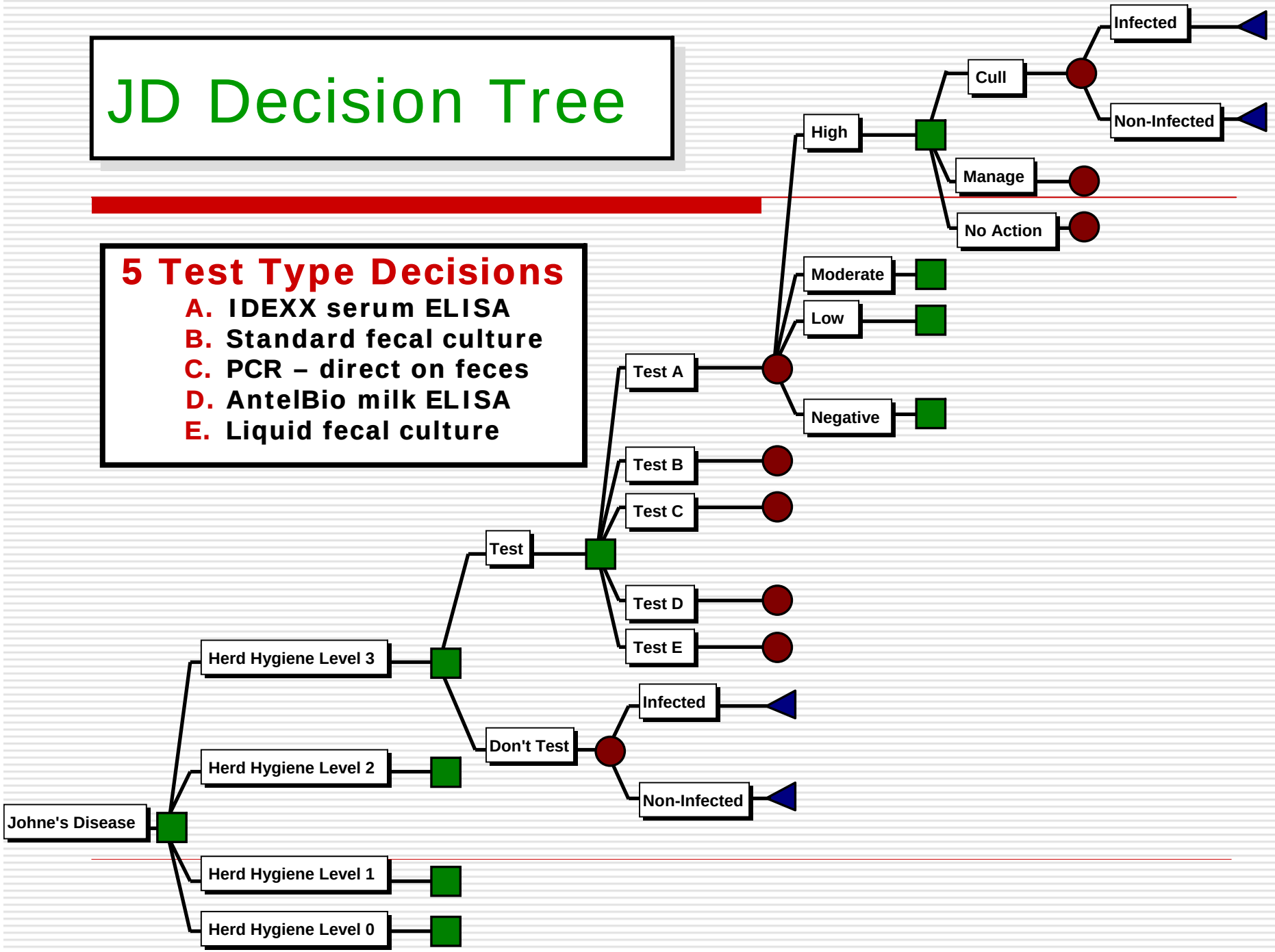
Nathan C. Dorshorst [a], Michael T. Collins [a,*], Jason E. Lombard [b]



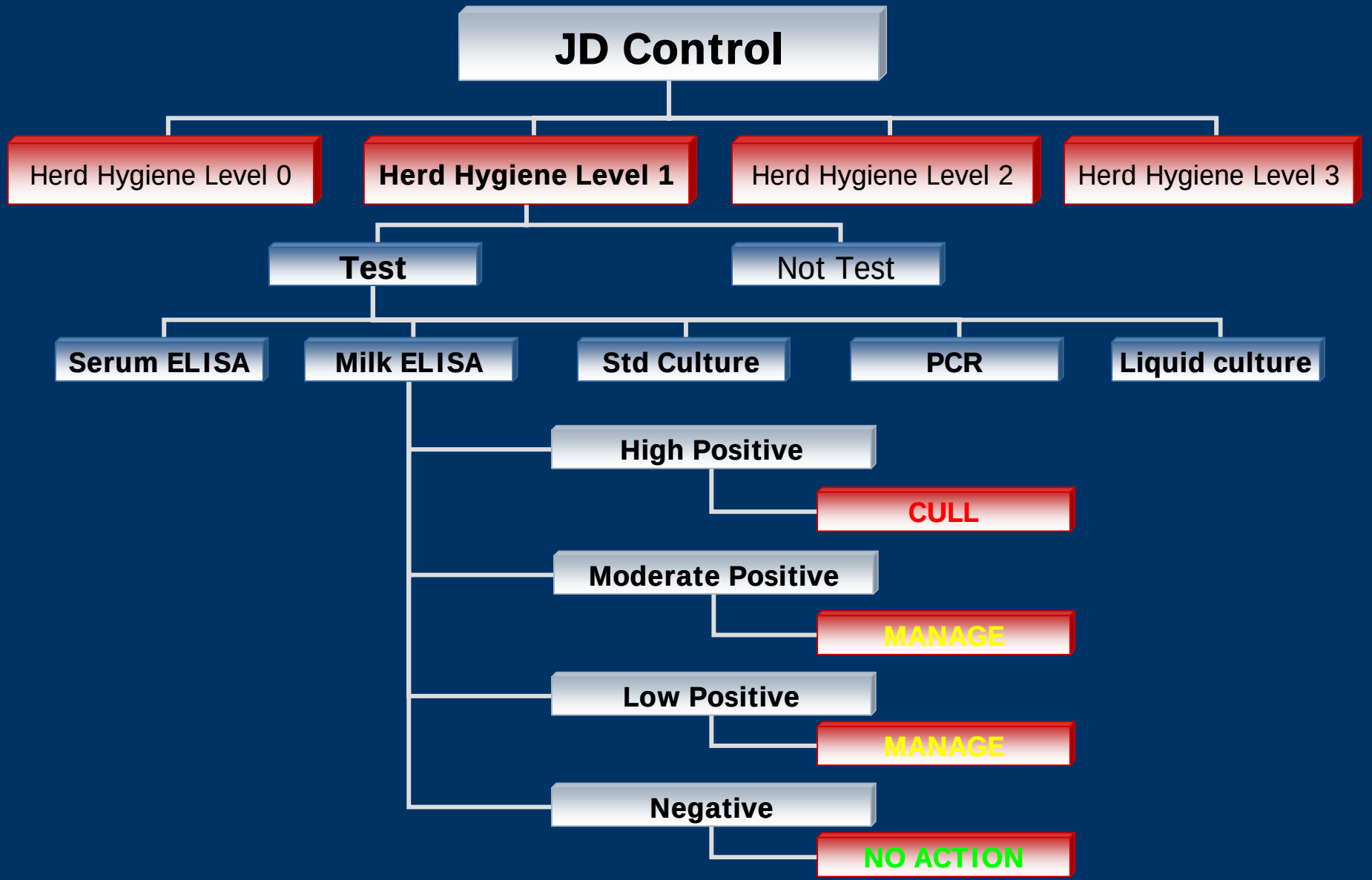
JD Decision Tree

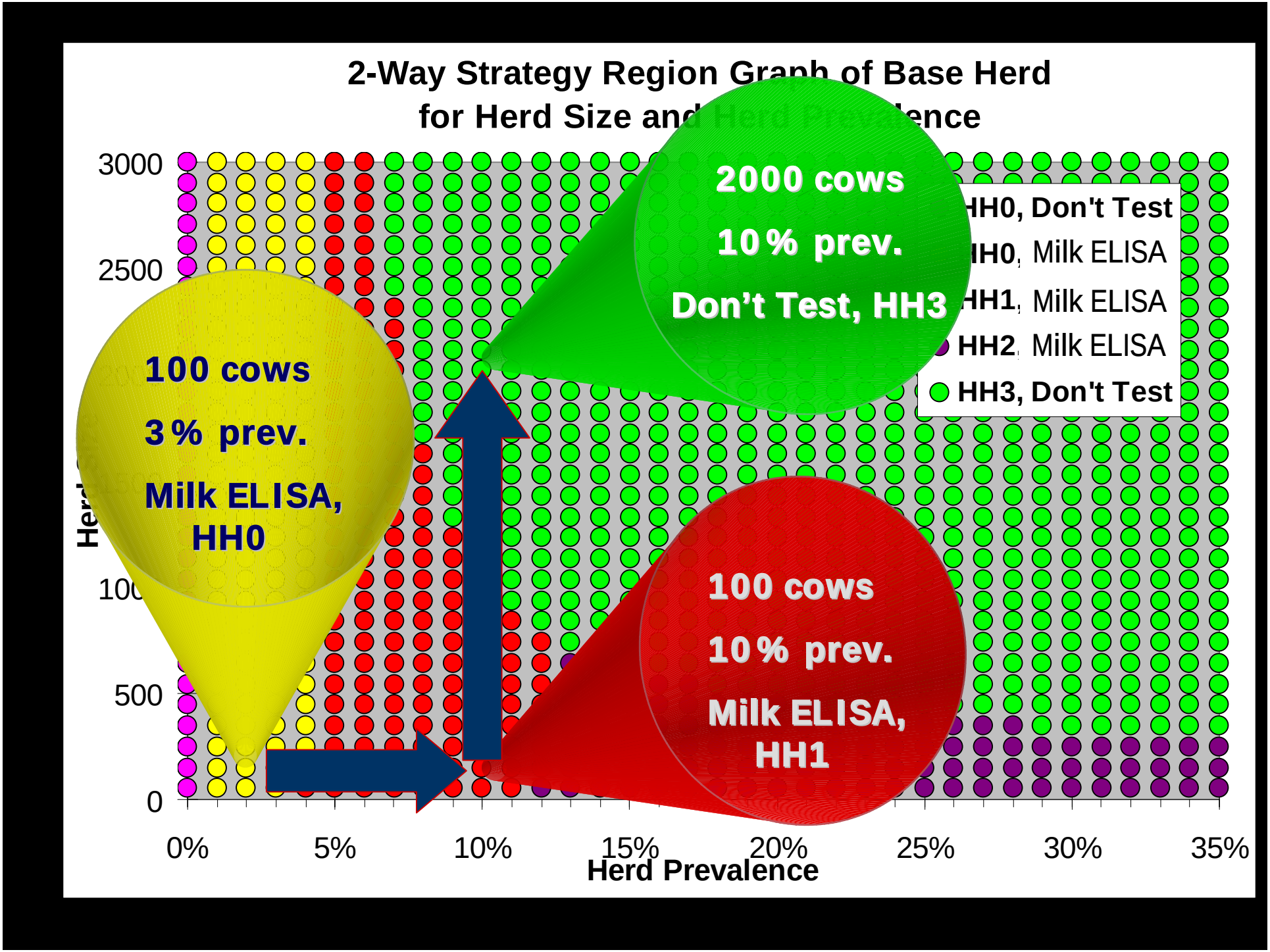
5 Test Type Decisions

A. IDEXX serum ELISA
B. Standard fecal culture
C. PCR – direct on feces
D. AntelBio milk ELISA
E. Liquid fecal culture



Optimal Program: Typical Herd (100 cows 10% infected)




2-Way Strategy Region Graph of Base Herd
for Herd Size and Herd Prevalence
3000
2500
100
500
0
0%
5%
10%
15%
20%
25%
30%
35%
Herd Prevalence
HH0, Don't Test
HH0, Milk ELISA
HH1, Milk ELISA
HH2, Milk ELISA
HH3, Don't Test
2000 cows
10% prev.
Don't Test, HH3
100 cows
3% prev.
Milk ELISA,
HH0
100 cows
10% prev.
Milk ELISA,
HH1

General Conclusions

- Within-herd prevalence is the most important variable affecting design of the optimal control program.
- Improved calf-hygiene is critical for paratuberculosis control programs & often more economical than testing.
- “Test-and-cull” strategies are NOT economically favorable for most producers; test-and-manage is preferred.
- For many herds, low-cost tests are more useful than higher cost, more accurate tests …i.e., milk ELISA “wins”.

One Scientist's Perspective on the Zoonosis Issue

Excerpt from the summation speech at the 9th International Colloquium on Paratuberculosis, Tsukuba, Japan November 2, 2007

Disclaimer: These opinions are my own. Do not blame the University of Wisconsin, the International Association for Paratuberculosis, Jason or the USDA.

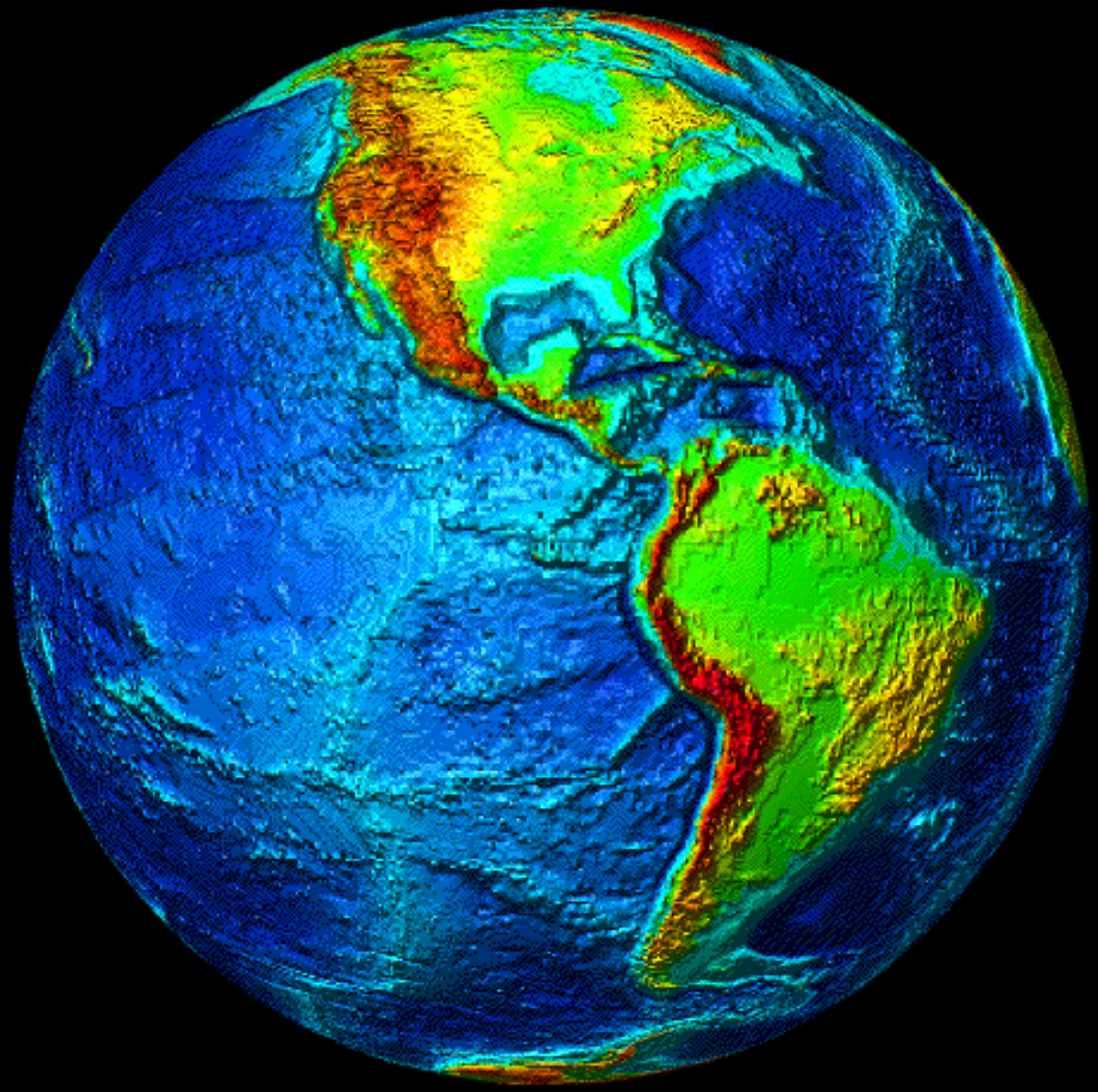
My View: Reductionist Research Has Obscured the Bigger Picture

We know….

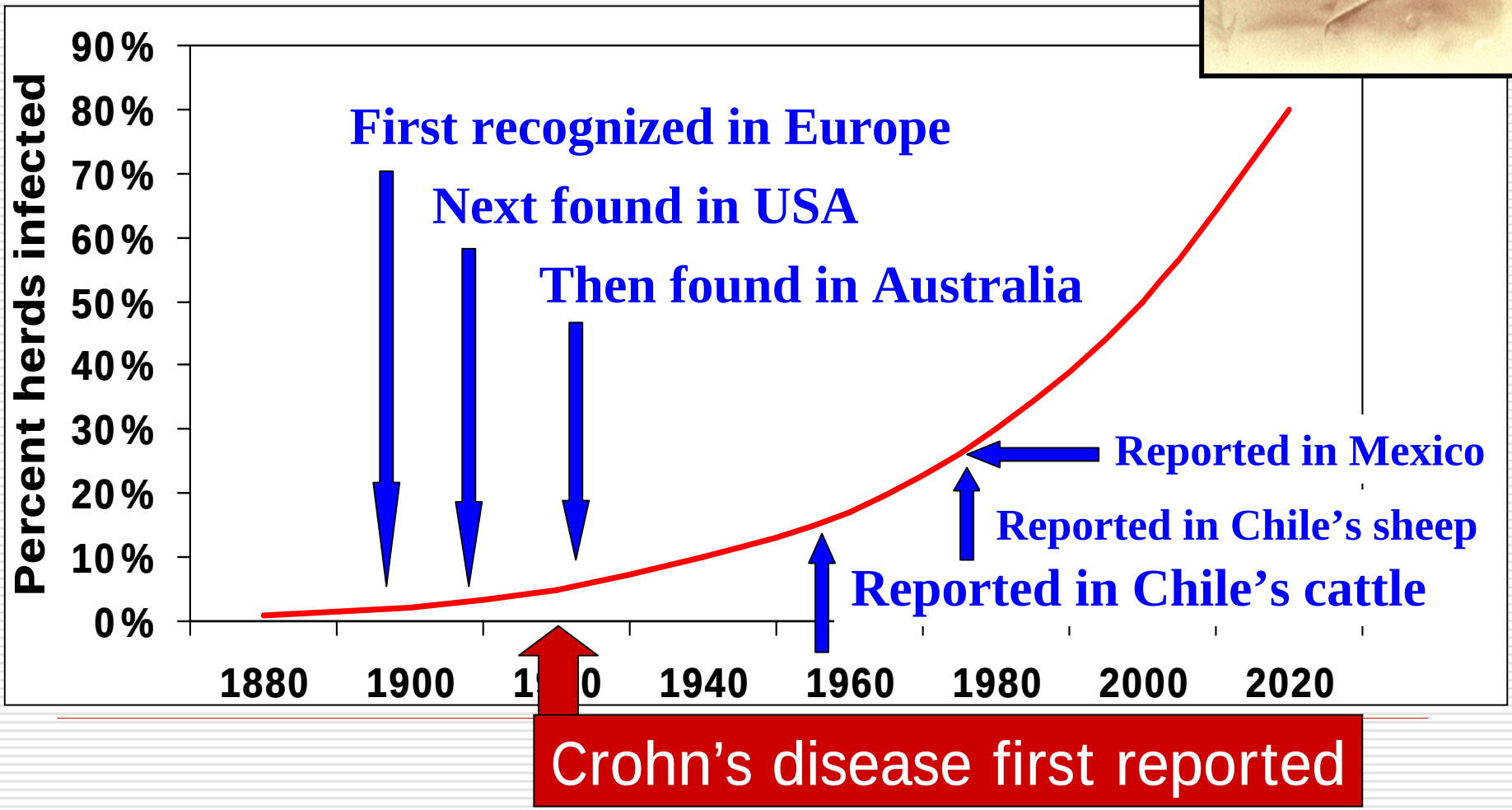
- ✓ The genomic sequenced of *M. paratuberculosis*
- ✓ The pathogenesis of paratuberculosis
- ✓ The epidemiology of paratuberculosis
- ✓ The accuracy of multiple diagnostic tests
- ✓ The best diagnostic tests for multiple purposes
- ✓ How to run diagnostic test proficiency programs
- ✓ How to control the infection
- ✓ How to certify herds as low risk of infection
- ✓ How to operate biosecurity programs

However……..

We Face An Expanding Global Problem



An Unchecked Epidemic

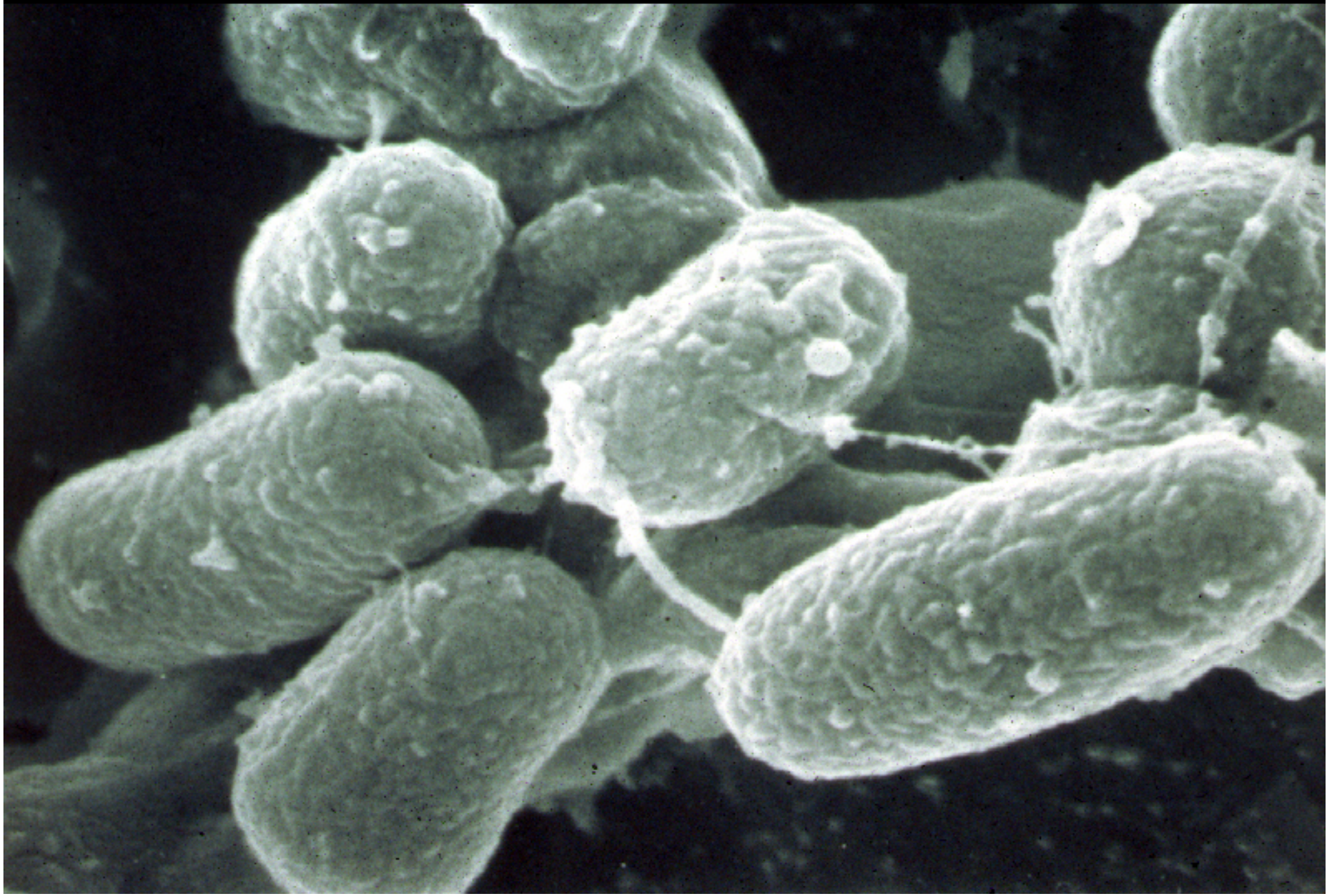


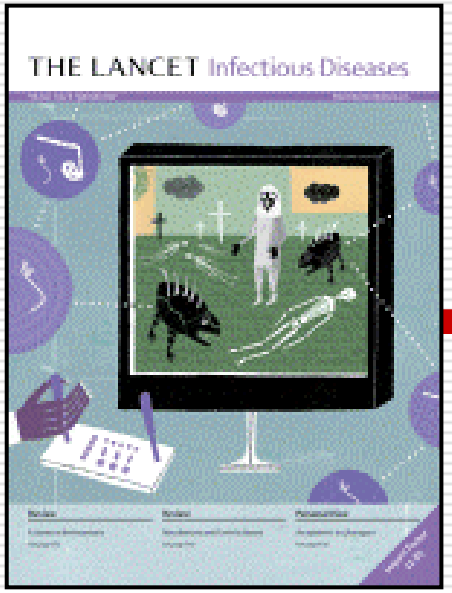
Why?

The cost of control exceeds the cost of the disease.

Consequences

Consistently Detected in Humans





September, 2007

Mycobacterium avium subspecies *paratuberculosis* and Crohn's disease: a systematic review and meta-analysis

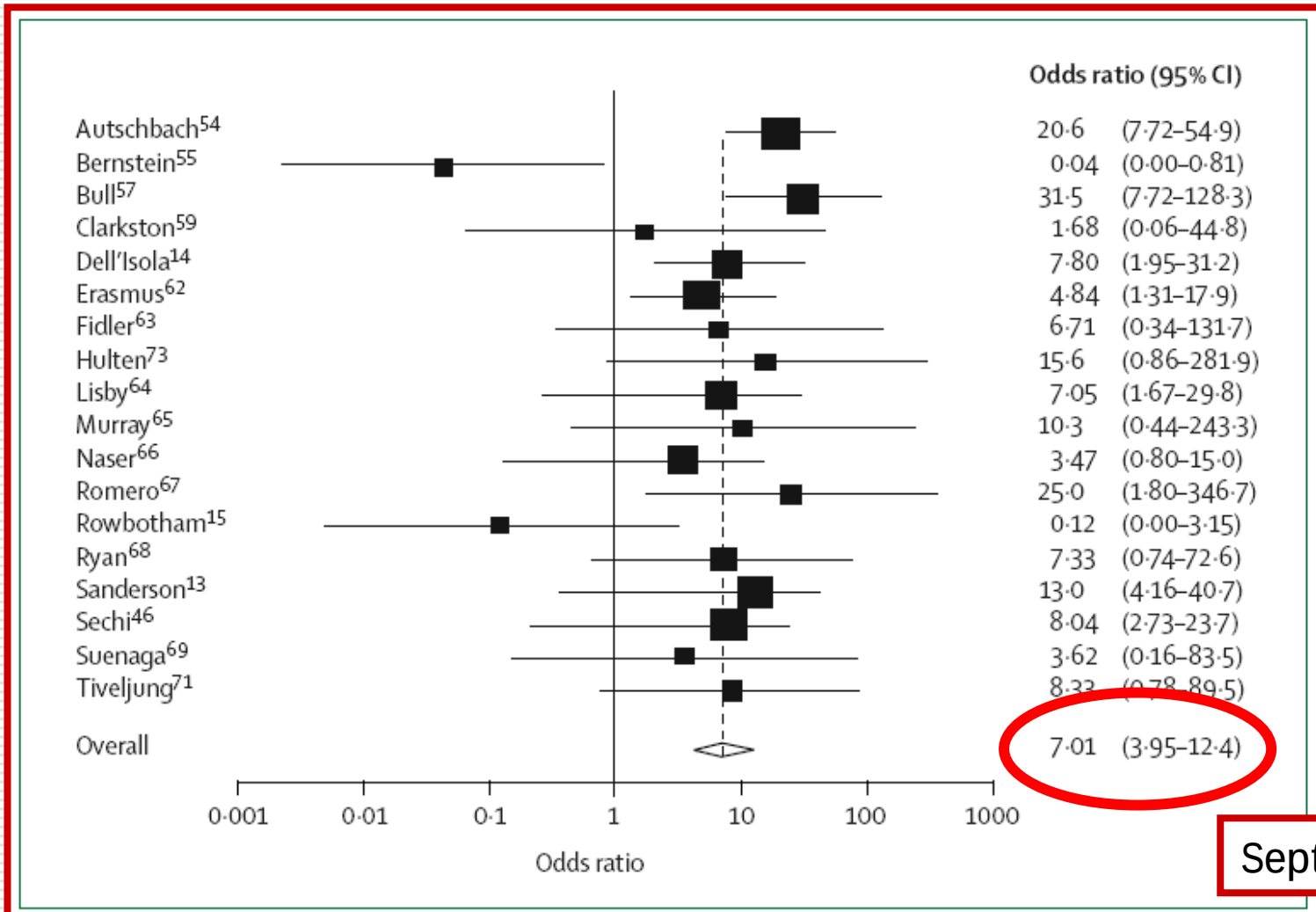
Martin Feller, Karin Huwiler, Roger Stephan, Ekkehardt Altpeter, Aijing Shang, Hansjakob Furrer, Gaby E Pfyffer, Thomas Jemmi, Andreas Baumgartner, Matthias Egger

This systematic review assesses the evidence for an association between *Mycobacterium avium* subspecies *paratuberculosis* (MAP) and Crohn's disease. We analysed 28 case-control studies comparing MAP in patients with Crohn's disease with individuals free of inflammatory bowel disease (IBD) or patients with ulcerative colitis. Compared with individuals free of IBD, the pooled odds ratio (OR) from studies using PCR in tissue samples was 7·01 (95% CI 3·95–12·4) and was 1·72 (1·02–2·90) in studies using ELISA in serum. ORs were similar for comparisons with ulcerative colitis patients (PCR, 4·13 [1·57–10·9]; ELISA, 1·88 [1·26–2·81]). The association of MAP with Crohn's disease seems to be specific, but its role in the aetiology of Crohn's disease remains to be defined.

Lancet Infect Dis 2007; 7: 607–13

Institute of Social and Preventive Medicine (ISPM), University of Bern, Bern, Switzerland (M Feller, K Huwiler MD, A Shang MD, Prof M Egger MD); Institute for

"The association of MAP and Crohn's disease, based on PCR or ELISA testing, is well established and we doubt that important further insights may be gained from additional case-control studies...."



September, 2007

Figure 1: Meta-analysis of 18 comparisons from case-control studies of patients with Crohn's disease versus controls, with PCR in tissue samples or blood to detect *M avium* subspecies *paratuberculosis* (MAP)

REVIEW ARTICLE

Detection of *Mycobacterium avium* Subspecies *paratuberculosis* from Patients with Crohn's Disease Using Nucleic Acid-Based Techniques: A Systematic Review and Meta-analysis

I. Abubakar, MD, PhD, D. Myhill, PhD,* S.H. Aliyu, MD,† and P.R. Hunter, MD**

"...there is an association between MAP and CD, across many sites, by many investigators, and controlling for a number of factors..."

Inflamm. Bowel Dis. Epub

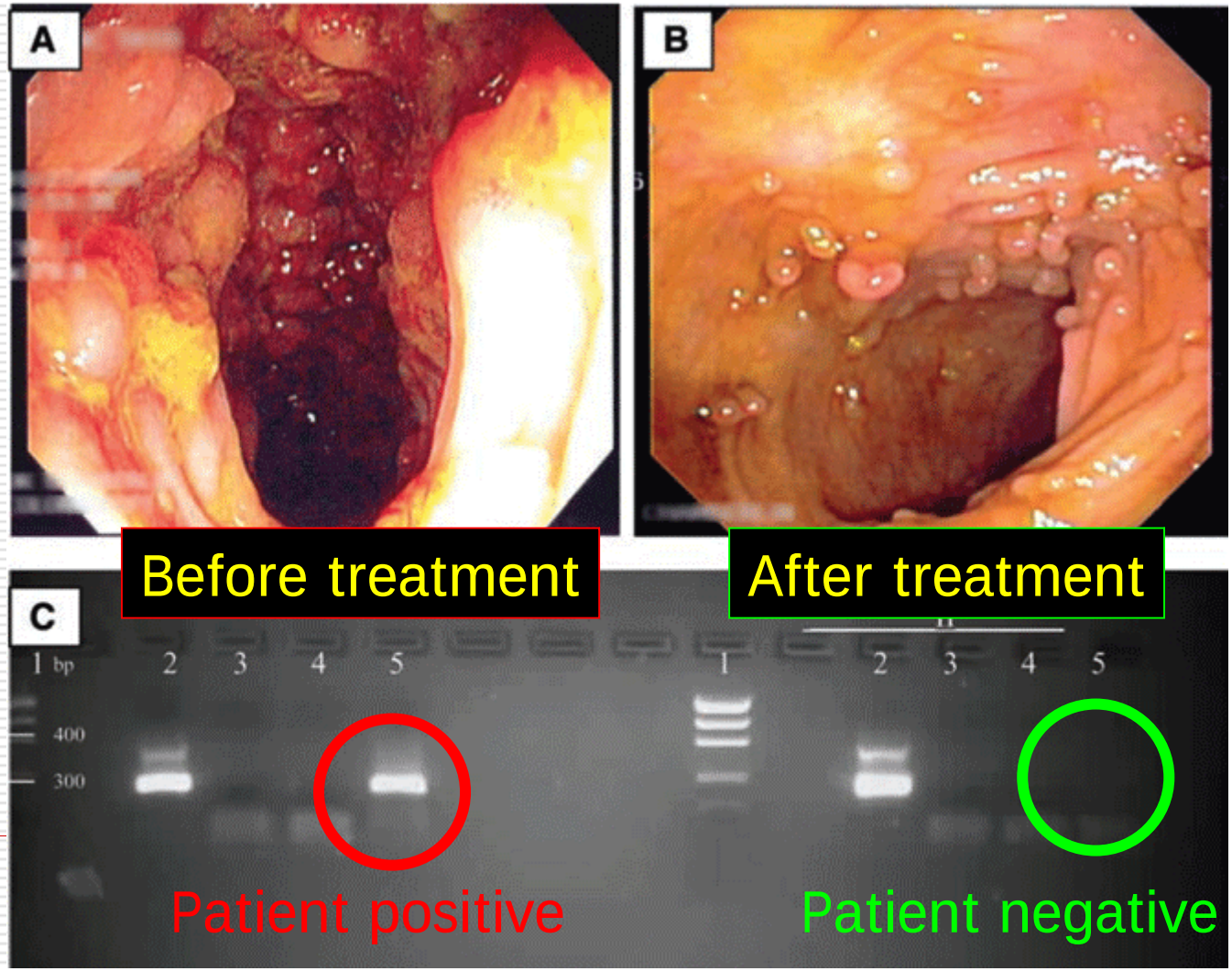
“The present study presents evidence for the existence of both human disease-associated genotypes and strain sharing with animals”.

Successful treatment of a Crohn's disease patient infected with *Mycobacterium paratuberculosis*.

Chamberlin et al. Am. J. Gastroenterol. Jan. 2007.

Endoscopy

IS900 PCR

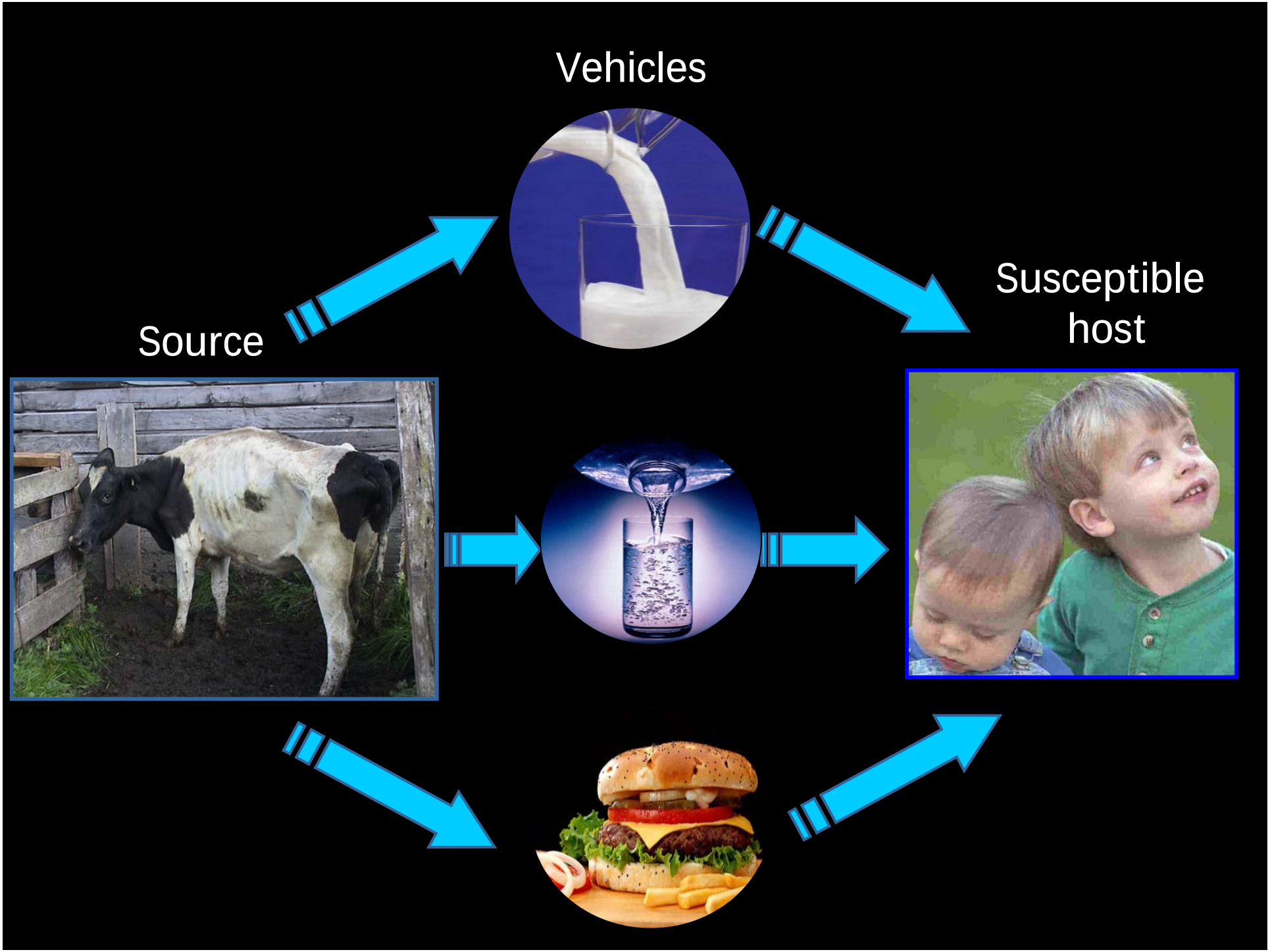


“Our data emphasize that because the prevalence of the gene is likely to be static, there must be a changing **environmental factor** which plays a major role in precipitating clinical illness.”

Complex Epidemiology

but

Understandable


Vehicles
Source
Susceptible host

The Farm is the Critical Control Point

- Use HACCP Principles –

Place multiple hurdles between *Mptb* source and calves or consumers

- ☑ Prevent infection of herds
- ☑ Limit infection spread on farms
- ☑ Test herds and cull positive cattle
- ☑ Collect meat and milk hygienically
- ☑ Pasteurize all dairy products

Food safety: “teat to tongue” or “moo to you”

Paratuberculosis and Food Safety:
An Inconvenient Truth?

"A truth we hold at arm's length because if we acknowledge it and recognize it, then the moral imperative to make big changes is inescapable".

Al Gore

Increasing Awareness

U.S. Centers for Disease Control

Expanding and strengthening diagnostics and reporting for non-tuberculous mycobacteria (NTM)

Report due in 2008

U.S. National Advisory Committee on the Microbial Criteria for Food

USDA/FDA joint committee

Subcommittee on Assessment of the Food Safety Importance of *Mycobacterium avium* subspecies *paratuberculosis* (MAP)

Report due in early 2008

American Academy of Microbiology

Mycobacterium paratuberculosis: Incidental Human Pathogen or Public Health Threat?

Met June 15-18, 2007, Salem, MA.

Report due in 2008