

### One Health: Beyond Medicine

**The Union**  
International Union Against Tuberculosis and Lung Disease  
www.who.int/tb

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**Dr. Francisco Olea-Popelka, DVM, MSc, PhD**

**Colorado State University**  
COLLEGE OF  
VETERINARY MEDICINE  
& BIOMEDICAL SCIENCES

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### What do these two doctors have in common?

**Dr. House**

**JAMES HERRIOT**  
Every Living Thing

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### Highlight the interplay between animal, human, and environmental health

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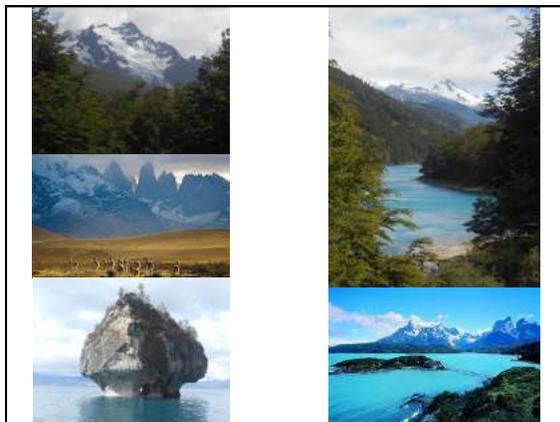
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*Chile, 1984*



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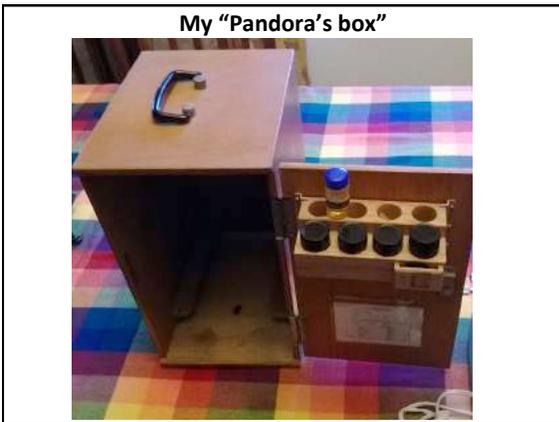
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My "Pandora's box"



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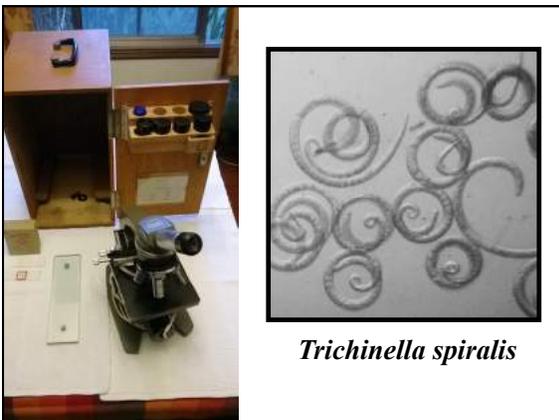
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*Trichinella spiralis*

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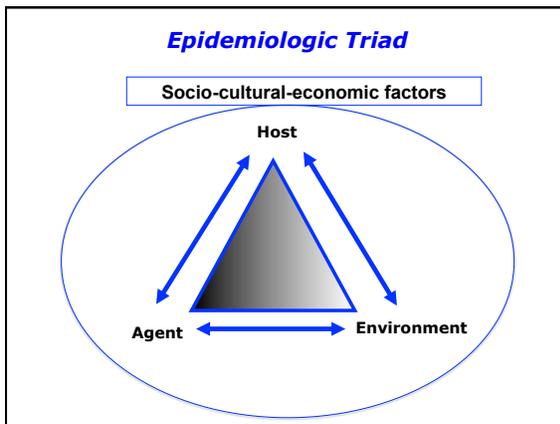
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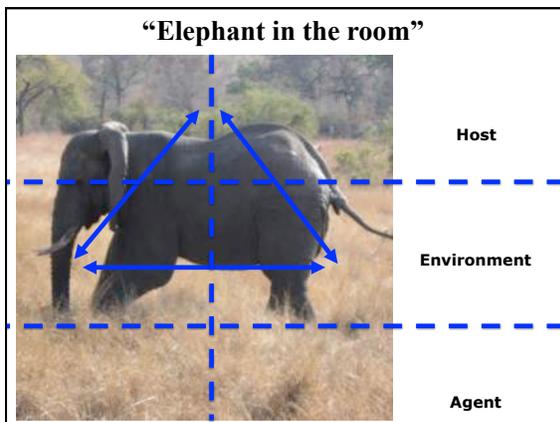
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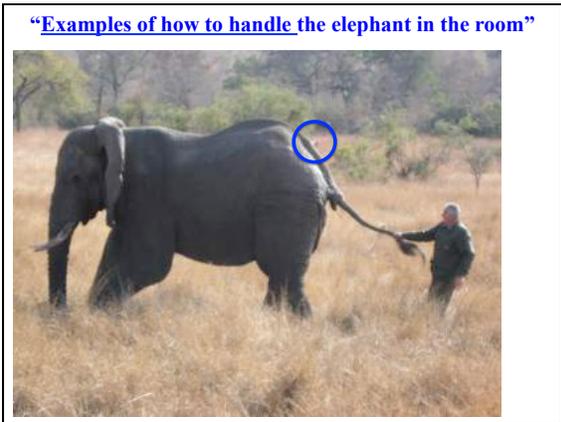
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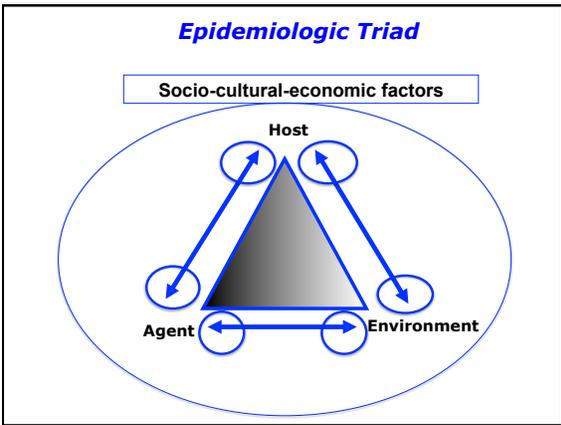
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Preventive Veterinary Medicine 101 (2011) 148–156

Contents lists available at ScienceDirect

**Preventive Veterinary Medicine**

ELSEVIER journal homepage: [www.elsevier.com/locate/prevetmed](http://www.elsevier.com/locate/prevetmed)

From “one medicine” to “one health” and systemic approaches to health and well-being<sup>☆</sup>

J. Zinsstag<sup>a,\*</sup>, E. Schelling<sup>a</sup>, D. Waltner-Toews<sup>b</sup>, M. Tanner<sup>a</sup>

<sup>a</sup> Swiss Tropical and Public Health Institute/University of Basel, PO Box, CH-4002 Basel, Switzerland

<sup>b</sup> Ontario Veterinary College, University of Guelph, 50 Stone Road, Guelph, ON, Canada N1G 2W1

One Medicine, Translational/Comparative Medicine,  
Eco Health, Planetary Health

**One Health Initiative**

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**Louis Pasteur**



**Pasteurization**

Food Safety, Medical Instruments Sterilization, Public Health

Vaccines (Rabies and Anthrax)

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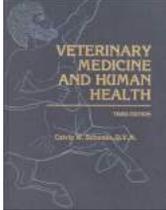
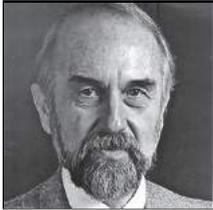
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**“One Medicine”**

**Dr. Calvin Schwabe**  
(1927-2006)



**There is no difference of paradigm between human and veterinary medicine.**

Both sciences share a common body of knowledge, in anatomy, physiology, pathology, on the origin of diseases in all species

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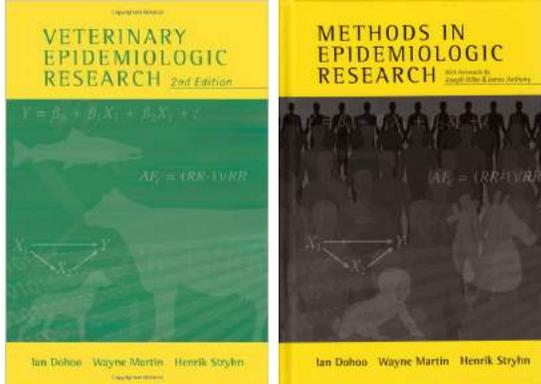
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**VETERINARY EPIDEMIOLOGIC RESEARCH** 2nd Edition

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots$$
$$AF_r = IRR \cdot IYRR$$

Ian Dohoo Wayne Martin Henrik Stryhn

**METHODS IN EPIDEMIOLOGIC RESEARCH**

$$AF_r = IRR \cdot IYRR$$

Ian Dohoo Wayne Martin Henrik Stryhn

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In April, 2005, *The Veterinary Record* and the *British Medical Journal (BMJ)* published simultaneous issues exploring how the **veterinary** and **medical** professions could collaborate for mutual benefit



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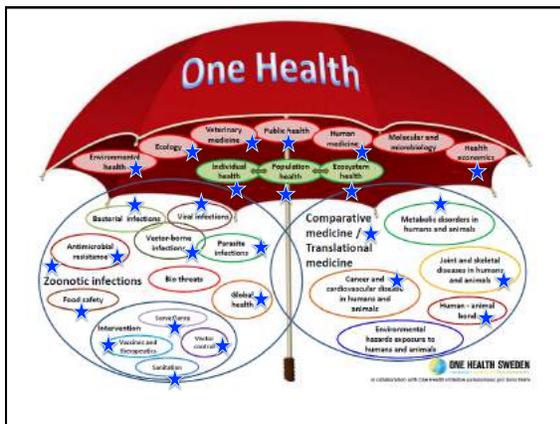
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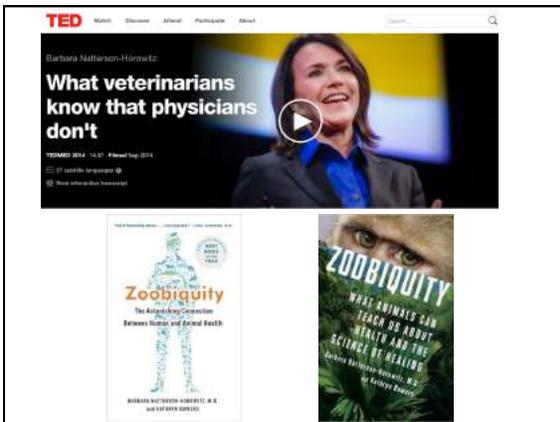
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### Beliefs about the cure for arthritis and cancer in humans (as well as vomiting, headaches, fever among others health issues)

#### RHINO STATISTICS - POACHED AND POPULATION FIGURES

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of Rhinos Poached	83	122	333	448	668	1004	1215	1175	?

**How many more this year?**

Over 1,000 known rhinos have been poached in South Africa in the last 8 years. There are only some 18,900 white and 7,000 black rhinos left in South Africa, which is some 75% of Africa's remaining rhino population.

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#### VALUE OF RHINO HORN (Per ounce)

Item	Value (Per ounce)
RHINO HORN	\$1,110 - \$6,850
GOLD	\$1,196
SILVER	\$16
COCAINE*	\$4,790
HEROIN*	\$12,757

SOURCE: United States Attorney for the District of New Jersey, United Nations Office on Drugs and Crime.

#### Rhino poaching: By the numbers

1 2 3 4 5

Click to play

1,000 rhinos poached in 2014 alone

The team's members are no ordinary veterinarians, but daily captures like this one are quickly becoming the norm for a team tasked with the care of Kruger's most threatened species. They've already conducted more than 30 relocations since last month, and will conduct hundreds more.

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### Relocating Kruger National Park's rhinos

Updated 7:00 PM ET, Sun November 20, 2014

Relocating Kruger National Park's rhinos

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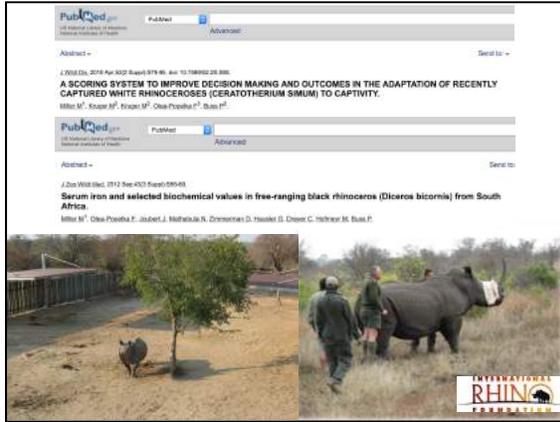
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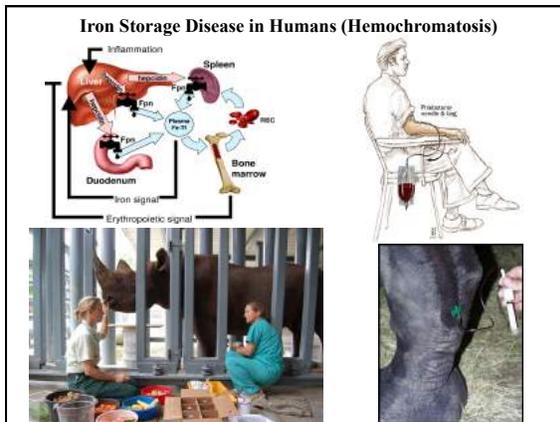
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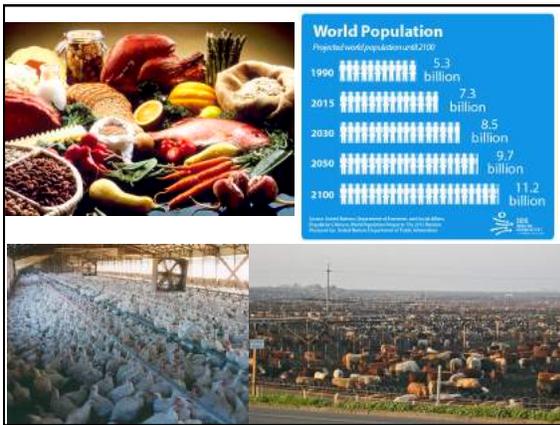
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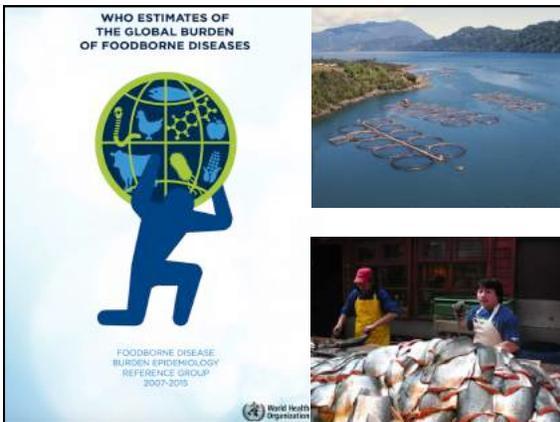
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### Perspectives on AMR

- From the Public and Press:
  - Appearance of Beta-lactam Resistance Genes in Agricultural Soils and Clinical Isolates over the Hyperbole
  - Rhetoric
- Debate exists about whether **agricultural versus medical antibiotic use** drives increasing antibiotic resistance (AR) across nature.
- Both sectors have been inconsistent at antibiotic stewardship, but it is unclear which sector has most influenced acquired AR on broad scales.

Microbial Ecology Group

Slide acknowledgement: Dr. Paul Morley, DVM, PhD

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### Competing Interests

- Global Food Security
- Increasing Affluence
- Changing Food Preferences
- Social Concerns
- Public Health
- Increasing Competition for Limited Resources

Land  
Energy  
Water  
Social Priorities  
Politics

Microbial Ecology Group

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### National Strategy for Combating Antibiotic-Resistant Bacteria

- PCAST report to President Obama (2014)  
*(President's Council of Advisors on Science and Technology)*
- White House Executive Order (2014)
- National Action Plan (March 2015)
  - Prevent Emergence and Spread of Resistant Bacteria
  - Strengthen Surveillance Efforts
  - Advance Development and Use of Rapid Diagnostic Tests
  - Accelerate Development for New Antibiotics, Other Therapeutics, and Vaccines.
  - Improve International Collaboration and Capacities for Antibiotic Resistance Prevention, Surveillance, Control, and Antibiotic Research and Development

Microbial Ecology Group

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Over the last 3 decades, approximately 70% of new emerging human infectious diseases have been zoonotic diseases (infections of animals transmitted to humans, and vice versa).

At the same time environmental insults will continue to create favorable environments for the development of new infectious diseases as well as an expanding number of non-infectious and chronic diseases and conditions.

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**“Talking about diseases people get from animals”**  
 ..... we need to be more careful.

*Although this usage simplifies some things for bureaucrats and managers, it obscures the fact that **people are animals** – exceptional animals, to be sure, **but animals nonetheless** – and that sharing of microbes among species is normal.*

.....allows people to fall back too readily into a kind of **delusional silo mentality**.

*“No realistic understanding of zoonoses and their control can be achieved without the contributions of:*  
**natural scientists (ecologists, entomologists, and zoologists), health scientists (veterinarians and physicians), historians, anthropologists, social scientists, artists, and just plain folks”**

Dr. David Waltner-Towes (DVM, PhD)

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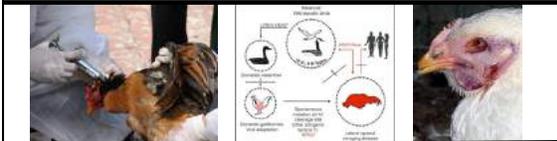
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## Avian Influenza (AI)

- Far more resources have been given to the detection and spread of AI in human populations with relatively **limited resources dedicated to the animal side** even though the disease can be prevented if the focus is on the animal side.




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**RABIES: THE FACTS** World Health Organization

**VIRUS TRANSMISSION**  
Saliva of infected animals  
**99%** of human cases are caused by **dog bites**  
The virus attacks the brain  
Rabies is **Fatal** once symptoms appear

**TREATMENT**  
Thorough washing of the wound with soap and vaccine injections can avoid symptoms and save lives.  
Seek immediate medical care if bitten.

**HOW TO PREVENT RABIES TRANSMISSION FROM DOGS?**  
Learn dog body language  
Raise public awareness  
**NO DOG BITE = NO RABIES**

**FATALITIES**  
Rabies affects **poor rural communities** mostly in Asia and Africa  
One death every **16** minutes  
**40%** of the victims are children younger than 15

**VACCINATING DOGS SAVES HUMAN LIVES**  
Rabies is **100% preventable**  
Vaccinating **70%** of dogs breaks rabies transmission cycle in an area at risk  
Every dog owner is concerned

28 September • World Rabies Day 2015 • #rabies

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**13<sup>th</sup> INTERNATIONAL SYMPOSIUM ON VETERINARY EPIDEMIOLOGY & ECONOMICS**  
MAASTRICHT 23-24 AUGUST 2012  
Maastricht University • Maastricht • The Netherlands • Belgium

**“..... change is what disease does”**  
David Rogers, Oxford University, 2012

- BTV-1
- BTV-2
- BTV-3
- BTV-4
- BTV-6
- BTV-8
- BTV-10
- BTV-11
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- BTV-13
- BTV-14
- BTV-15
- BTV-16

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**ZIKA**  
 Last Reported in Chile  
 Zika is a mosquito-borne virus that causes mild illness and is usually not life-threatening. It is most commonly spread to people by a bite from an infected mosquito.

**El Niño y enfermedades**  
 El Niño is a climate phenomenon that occurs every 3 to 7 years. It is characterized by a warming of the central and eastern tropical Pacific Ocean. This warming can lead to an increase in the number of mosquitoes, which can spread diseases such as Zika.

**La gripe (influenza)**  
 Influenza is a respiratory virus that causes the flu. It is spread through the air by coughing and sneezing. Symptoms include fever, cough, sore throat, and muscle aches.

**El virus de la fiebre amarilla**  
 Yellow fever is a viral disease that is spread by mosquitoes. It can cause a fever, headache, muscle pain, and in some cases, liver and kidney damage. It is most common in tropical and subtropical regions.

**El virus de la fiebre tifoidea**  
 Typhoid fever is a bacterial infection that is spread through contaminated food and water. It causes a high fever, headache, and muscle aches. It is most common in developing countries.

**El virus de la fiebre dengue**  
 Dengue fever is a viral disease that is spread by mosquitoes. It causes a high fever, headache, and muscle pain. It is most common in tropical and subtropical regions.

**El virus de la fiebre chikungunya**  
 Chikungunya is a viral disease that is spread by mosquitoes. It causes a high fever, joint pain, and muscle aches. It is most common in tropical and subtropical regions.

**El virus de la fiebre zika**  
 Zika is a viral disease that is spread by mosquitoes. It causes a mild illness and is usually not life-threatening. It is most commonly spread to people by a bite from an infected mosquito.

**The MERS virus**  
**Middle East Respiratory Syndrome Coronavirus (MERS-CoV)**  
 Family of common viruses that affect humans and animals, including the SARS virus, which killed nearly 800 people around the world in 2003.

**The camel connection:**  
 Seen as the likely source of the virus  
 The virus had previously been detected in a camel linked to a human case, but the relationship between humans, camels and the virus is not fully understood  
 Analysts published in February of blood samples from donkey camels found evidence of MERS going back two decades

**Ebola deaths**  
 Figures up to 1 November 2015

**11,314**  
 Deaths - probable, confirmed and suspected (includes one in the US and six in Mali)

**4,808** Liberia  
**3,955** Sierra Leone  
**2,536** Guinea  
**8** Nigeria

Source: WHO

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**Foot and Mouth Disease (FMD)**  
 (not a zoonotic disease)

If FMD gets into the USA, losses are expected on the range of **37 billion dollars** to the US economy.

The **psychological consequences** of introduction of FMD in the US could range from food safety **fears by the public**, to **severe distress of livestock producers**.

The top image shows a large number of sheep in a field, with a person in a green protective suit standing nearby. The bottom image shows a large fire burning in a field, with smoke rising into the air.

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habri  
HUMAN-ANIMAL BOND  
RESEARCH

RESEARCH

- ALLERGIES & IMMUNITY
- ALZHEIMER'S DISEASE
- AUTISM SPECTRUM DISORDERS
- CANCER
- CARDIOVASCULAR HEALTH
- DEPRESSION
- PTSD

RESEARCH

UNDERSTANDING THE HUMAN-ANIMAL BOND

SERVICE ANIMALS WELCOME

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habri central  
Resources for the Study of the Human-Animal Bond

Released December 19th, 2014

### Practitioner Attitudes and Beliefs Regarding the Role Animals Play in Human Health

Felicia Trembath, MPH

Although the health benefits of animals have been demonstrated across a variety of disciplines, there has been little investigation into the beliefs of practitioners about the role that animals play in health.

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Lakota Animal Care Project | Respecting All Our Relations

HOME ABOUT US AND WE ARE OUR WORK PROGRAMS VOLUNTEER VISITING VETS PROGRAM CHAMPIONS OUR REPORTS CONTACT

Education Program to Enhance Awareness & Compassion for All Our Relations

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Available online at www.elsevier.com  
ELSEVIER  
Parasitology 136 (2006) 57–70  
PREVENTIVE VETERINARY MEDICINE  
www.elsevier.com/locate/ypremed

Spatial relationship between *Mycobacterium bovis* strains in cattle and badgers in four areas in Ireland

F.J. Olea-Popelka<sup>a,\*</sup>, O. Flynn<sup>a</sup>, E. Costello<sup>a</sup>, G. McGrath<sup>a</sup>, J.D. Collins<sup>a</sup>, J. O’Keeffe<sup>a</sup>, D.F. Kelton<sup>a</sup>, O. Berke<sup>b,c</sup>, S.W. Martin<sup>a</sup>

**Discussion**

Despite the indications of sharing common strains between badgers and cattle within areas, and the existence of different strains among areas, the low extent of spatial clustering of most *M. bovis* strains from badgers lead us to speculate about the considerable distances that badgers might travel within each area, and to re-think the theory that badgers are spatially stable over time. This ecological component of the badger distribution can have an important effect in the epidemiology of the disease, and some studies (Tuytens et al., 2000b; Donnelly et al., 2003; Roper, 2003) have given special attention to such an effect. This aspect of badger ecology needs to be considered in future studies of *M. bovis* transmission between cattle and badgers, especially when attempting to effectively control the disease in badger populations.

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**Controversial badgers results**

**“Badgers are different in Ireland vs. GB”**

(Francisco Olea-Popelka, at a conference in GB)

**Ireland** **GB**

**Population densities**

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Numbers of badgers culled per unit area in Ireland Four Area Project and the RBCT in GB  
(Woodroffe et al., 2006)



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**Oxford University, England, June 8<sup>th</sup> 2007** 

**Meeting with members of the Independent Scientific Group**

Preventive Veterinary Medicine 104 (2012) 185–197

Contents lists available at ScienceDirect

**Preventive Veterinary Medicine**

ELSEVIER journal homepage: www.elsevier.com/locate/prevetmed

Review

**An ecological and comparative perspective on the control of bovine tuberculosis in Great Britain and the Republic of Ireland**

Catherine M. O'Connor<sup>a,\*</sup>, Daniel T. Haydon<sup>b</sup>, Rowland R. Kao<sup>a</sup>

<sup>a</sup> Boyd Orr Centre for Population and Ecosystem Health, Institute for Biodiversity, Animal Health and Comparative Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, James Building, 499 Broomfield Rd, Glasgow G61 1QH, United Kingdom  
<sup>b</sup> Boyd Orr Centre for Population and Ecosystem Health, Institute for Biodiversity, Animal Health and Comparative Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, Graham Kerr Building, University Avenue, Glasgow G12 8QQ, United Kingdom



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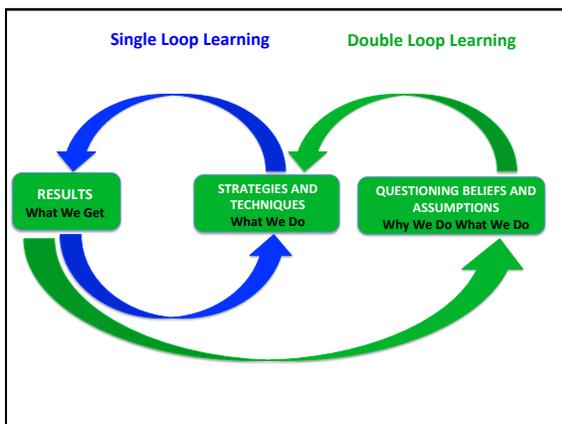
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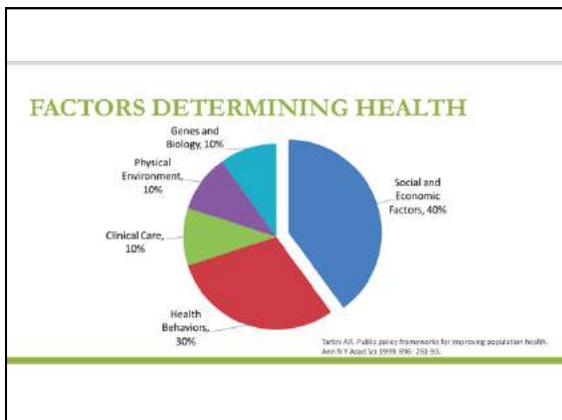
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**USA health facts**

- The human health care system in the US is actually a **disease care system**.

- Almost 98% of all US expenditures in the system are spent on addressing diseases and only about 2% on prevention.  
(King LJ. Veterinary medicine and public health at CDC. MMWR Morb Mortal Wkly Rep 2006; 55(suppl 2):7-9)

**The concept of One Health**

↓                      ↓

Is very much a strategy with a long-overdue bias **towards health promotion and disease prevention** across the human, livestock, wildlife, and the environment.

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**Human health benefits from livestock vaccination for brucellosis: case study**

Felix Roth,<sup>1</sup> Jakob Zinstag,<sup>1</sup> Dantor Orkhon,<sup>2</sup> G. Chimed-Ochir,<sup>3</sup> Guy Hutton,<sup>1</sup> Ottorino Cosivi,<sup>4</sup> Guy Carrin,<sup>4</sup> & Joachim Otte<sup>5</sup>

**Objective** To estimate the economic benefit, cost-effectiveness, and distribution of benefit of improving human health in Mongolia through the control of brucellosis by mass vaccination of livestock.

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**Colleges:**

- Agricultural Sciences
- Business
- Engineering
- Health and Human Sciences
- Liberal Arts
- Natural Resources
- Natural Sciences
- Veterinary Medicine and Biomedical Sciences

**Colorado State University**

**ONE HEALTH INITIATIVE**

Students Create "One Health" Club - **First**

... have been keeping their fingers on the pulse of the ... With the release of the American Veterinary Medical Association report, there is an increased awareness of the initiative ... tertiary, human, and environmental health. The One Health ... among health science professionals, academic institutions, ... have the significant global health and environmental

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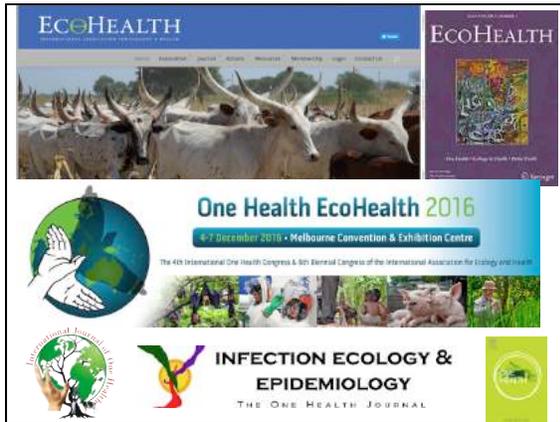
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Why has zoonotic tuberculosis not received much attention?

**Two major challenges to understand the true incidence (prevalence) of ZTB**

Lack of systematic surveillance for *M. bovis* as a causal agent of TB in people in **low-income, high TB burden** countries where bovine TB is endemic.

Inability of laboratory procedures most commonly used to diagnose human TB to identify and differentiate *M. bovis* from *M. tb*.

The block contains two small images. The top one shows a man standing with several cows in a field. The bottom one is a close-up of a green, rod-shaped bacterium, likely Mycobacterium bovis.

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**ZOONOTIC TUBERCULOSIS**

**ELUSIVE**  
 → *Mycobacterium bovis*  
 (usually indistinguishable from *Mycobacterium tuberculosis*)  
 Lack of unique diagnostic tests  
 TRUE NUMBER of infections?

**GLOBAL**  
 higher risk in countries where bovine TB is uncontrolled  
 UNPASTEURIZED DAIRY PRODUCTS are a common source

**CHALLENGING**  
 Current diagnostics & surveillance are INSUFFICIENT.  
 RESISTANCE & EXTRA-PULMONARY TB lesions complicate treatment.

**WHO ESTIMATES OF THE GLOBAL BURDEN OF FOODBORNE DISEASES**

**END TB by 2035: every case counts!**

121,268 new cases in 2010

10,545 deaths

Longer treatment (9 months up to 12 months)  
 Increased cost (\$\$\$)  
 Increased risk of incomplete treatment regime  
*M. bovis* drug resistance

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### Vulnerable communities

- The risk of ZTB increases for people living in communities with:
  - Higher prevalence of bovine TB in livestock
  - Lack of milk pasteurization
  - Human immunodeficiency virus (HIV)
- The people at risk and affected by ZTB are the **most neglected**, living in **rural** areas far away from health centers.

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**“People don't care how much you know until they know how much you care”**

President Theodore Roosevelt

...and how much **you do** about what you care

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The Union International Union Against Tuberculosis and Lung Disease Health solutions for the poor

WHO WE ARE WHAT WE DO WHERE WE WORK

WHO WE ARE

### The Union: from evidence to public health action

The Union draws from the best scientific evidence and expertise to advance solutions to public health challenges affecting people living in poverty.

**TUBERCULOSIS - TOBACCO USE - HIV AND AIDS - LUNG DISEASE - NON-COMMUNICABLE DISEASES**

Our partners include governments, international agencies, civil society and the private sector.

**"Know, Share, Act. These principles have driven The Union's work since its founding nearly 100 years ago."**  
— José Luis Castro, Executive Director, The Union

**KNOW** **SHARE** **ACT**

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**"What is knowledge if you don't use it!"**

Dr. Jane Carter  
International Union  
Against Tuberculosis and Lung Disease  
President

Dr. Paula I. Fujiwara  
International Union  
Against Tuberculosis and Lung Disease  
Scientific Director

Dr. Jose Luis Castro  
International Union  
Against Tuberculosis and Lung Disease  
Executive Director

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## Zoonotic TB now in the Global Plan to Stop TB

**THE PARADIGM SHIFT** 2016-2020

Stop TB Partnership  
A Collaborative Partnership United Nations @ UN/WHO

Global Plan to End TB **END TB**

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**Developing a ZTB “Road Map”**



**to implement actions to address the prevention, diagnosis, and treatment challenges faced by ZTB patients**

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**What do these two doctors have in common?**



Dr. House vs. James Herriot

**Who is better?**

**Who is more important?**

**Which one is cooler?**

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***“at the intersection of differences can always be found opportunities for creative ideas, innovations and profound transformation”***

*One Health Initiative*

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**Dr. Calvin Schwabe**



“Cultivation of an integrating mindset within One Medicine through epidemiology can have an important personal spillover into  
**more realistically understanding our species’ place in nature**  
and our **country’s place among the many other countries in the world”.**

Professor Calvin W. Schwabe, Class 1990

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**Thank you for your attention!**  
email: [folea@colostate.edu](mailto:folea@colostate.edu)



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**Extras**

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