



# ONE HEALTH

## Engaging in a Multidisciplinary Approach

*Comments by*

**Bernadette Dunham, D.V.M., Ph.D.**

Visiting Professor

Milken Institute School of Public Health

The George Washington University

Former Director

Center for Veterinary Medicine, FDA

*For*

**The MO Valley PDA**

04/17/2017



# Outline of today's presentation

- Introduction to "One Health"
- Setting the stage
- Emerging and Re-emerging Zoonotic Diseases (Example: Zika virus, Lyme disease)
- Environmental Sentinels:
  - Lead Poisoning, White-nose Syndrome, Colony Collapse Disorder, Coral reefs
- Climate Change.
- Preventing Diseases through Healthy Environments.
- Translational Biology:
  - Oncology, Craniofacial reconstruction, drug warnings
- New therapies for companion animal medicine
- Obesity and Type II diabetes.
- Antimicrobial Resistance (AMR):
  - Minnesota Department of Health - Laboratory data sets, Annual World Veterinary Day-AMR Theme for 2017
- One Health Case Studies for Academia.
- Human-Animal Interactions.
- One Health Opportunities.
- Engaging in a Multidisciplinary One Health Approach.
- Annual One Health Day Nov. 3<sup>rd</sup>

# One Health Defined

"One Health is the collaborative effort  
of multiple disciplines  
- working locally, nationally, and globally -  
to attain optimal health  
for people, animals, and our environment."

*AVMA One Health Initiative Task Force 2008*



# Why One Health?

4

- Worldwide, nearly 75 percent of all emerging human **infectious diseases** in the past three decades originated in animals.
- **Climate change**, increased CO2 levels, land-use changes, resource scarcity, decreased biodiversity, loss of pollinators, dams and irrigation projects, air and water pollution, and encroachment into wildlife habitat are just a few of the items impacting the ecosystem which in turn affects the health of humans and animals.
- The **world population** is projected to grow from 7.4 billion in 2016 to 9 billion by 2050... further increasing humanity's ecological footprint.
- To provide adequate **healthcare, safe food** and **safe water** for the growing global population... a collaborative and trans-disciplinary approach is needed (e.g. agricultural scientists, anthropologists, economists, educators, engineers, entomologists, epidemiologists, hydrologists, microbiologists, nutritionists, physicians, policy makers, public health professionals, sociologists, and veterinarians ... working together! ).
- The **human-animal bond** beneficially impacts the health of both people and animals... a unique role in the scope of One Health.



### Mission Statement:

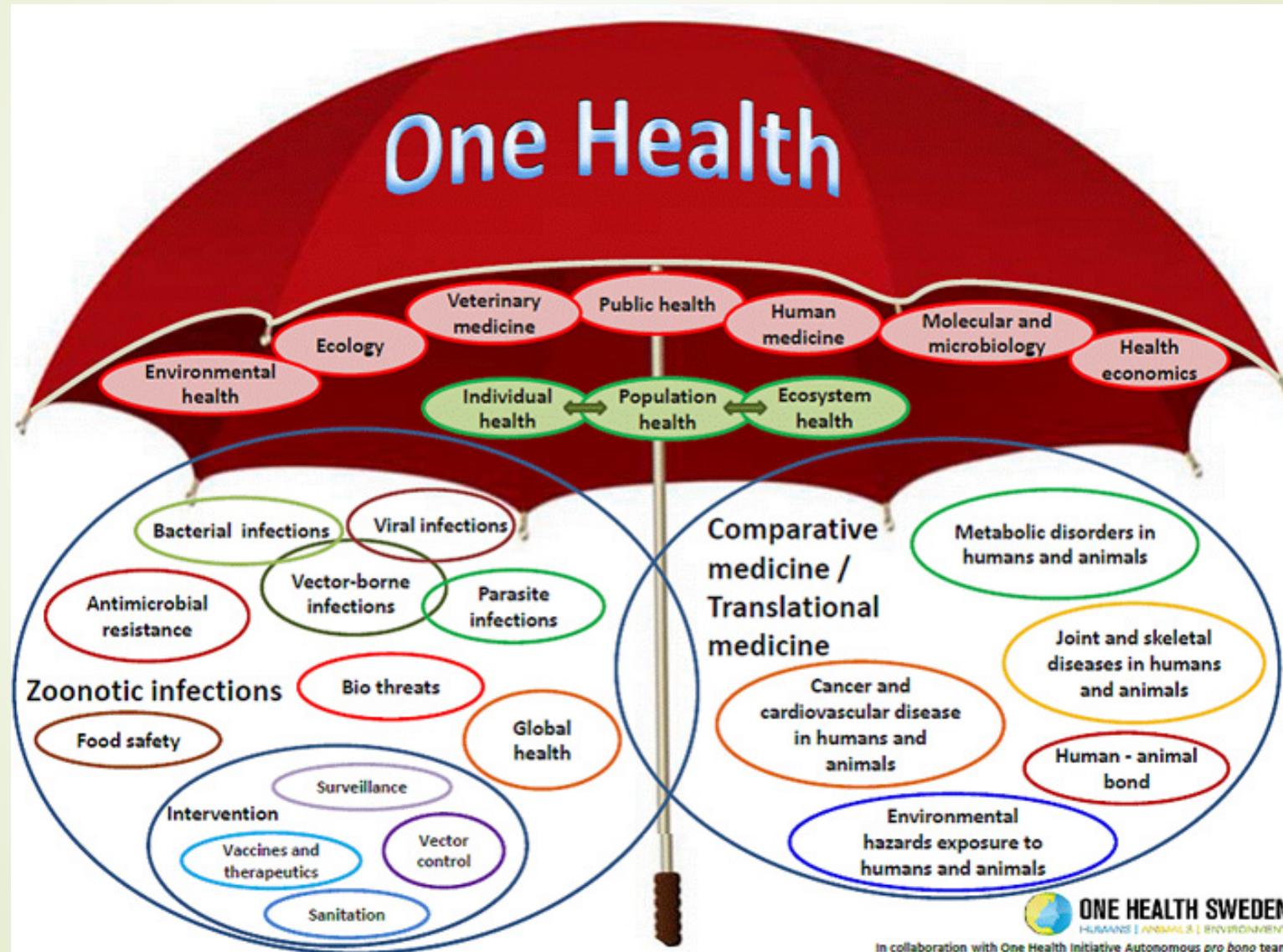
Recognizing that human health (including mental health via the human-animal bond phenomenon), animal health, and ecosystem health are inextricably linked, One Health seeks to promote, improve, and defend the health and well-being of all species by enhancing cooperation and collaboration between physicians, veterinarians, other scientific health and environmental professionals and by promoting strengths in leadership and management to achieve these goals.

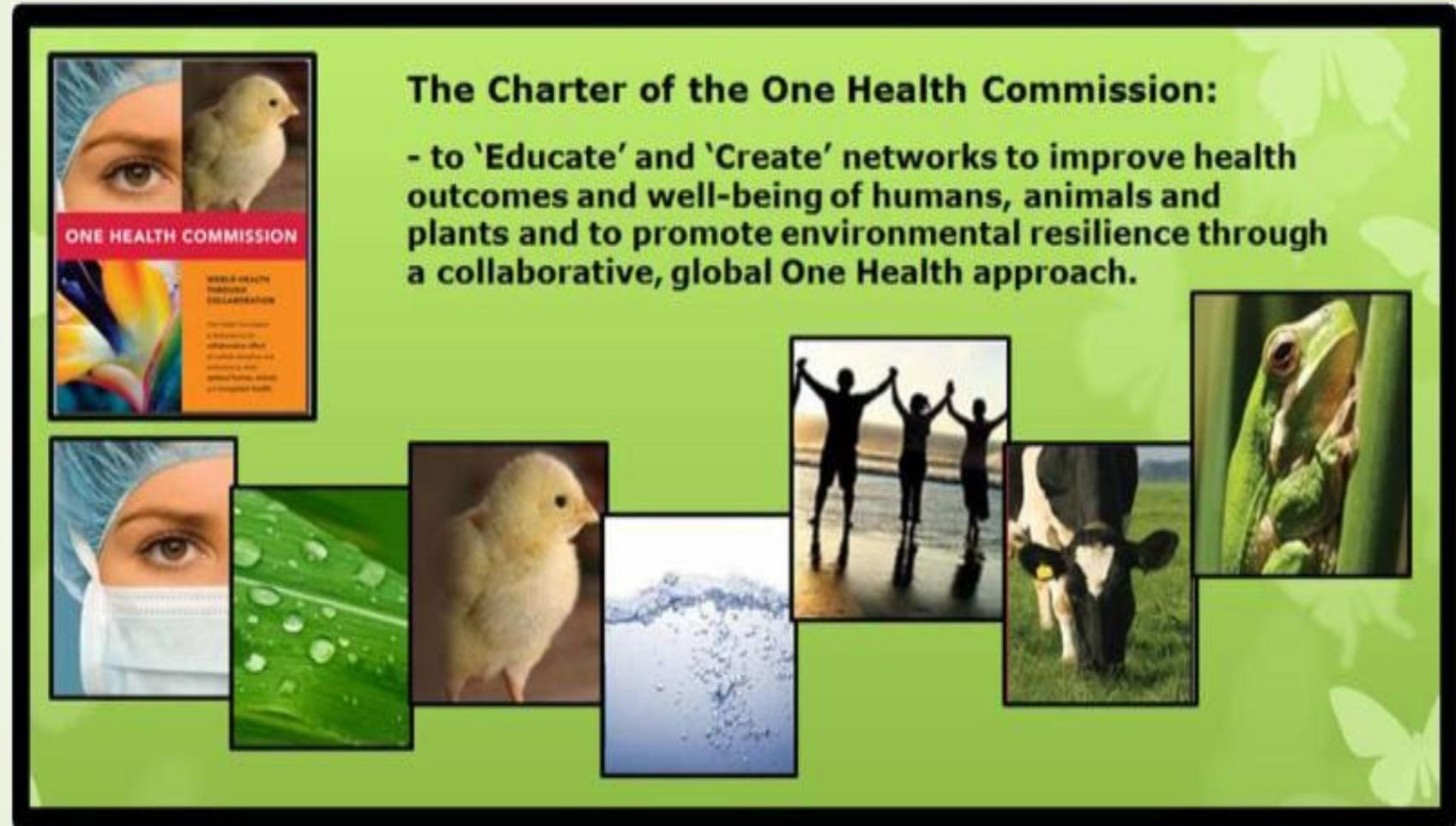
**One Health Initiative Website:** <http://www.onehealthinitiative.com/mission.php>

(The One Health Initiative Autonomous *pro bono* team (OHI) was co-founded in 2006.)

# Scope of 'One Health' as per the One Health Initiative

6





**The Charter of the One Health Commission:**

- to 'Educate' and 'Create' networks to improve health outcomes and well-being of humans, animals and plants and to promote environmental resilience through a collaborative, global One Health approach.

**One Health Commission Website: <https://www.onehealthcommission.org/>**

(The One Health Commission is a globally focused organization dedicated to promoting improved health of people, domestic animals, wildlife, plants and the environment. It is a 501(c)(3) organization, chartered in Washington, D.C. on June 29, 2009.)



**Mission:** The One Health Platform is a strategic forum of stakeholders and a One Health reference network that aims to enhance understanding of and preparedness for the current and future outbreaks of zoonoses, emerging infectious diseases in humans and animals, and antimicrobial resistance, including the ecological and environmental factors which impact on these diseases.



**Creating a healthy future for humans, animals and their environments.**



**The One Health Platform website: <http://onehealthplatform.com/>**

(The One Health Global Network Webportal was established in 2011)

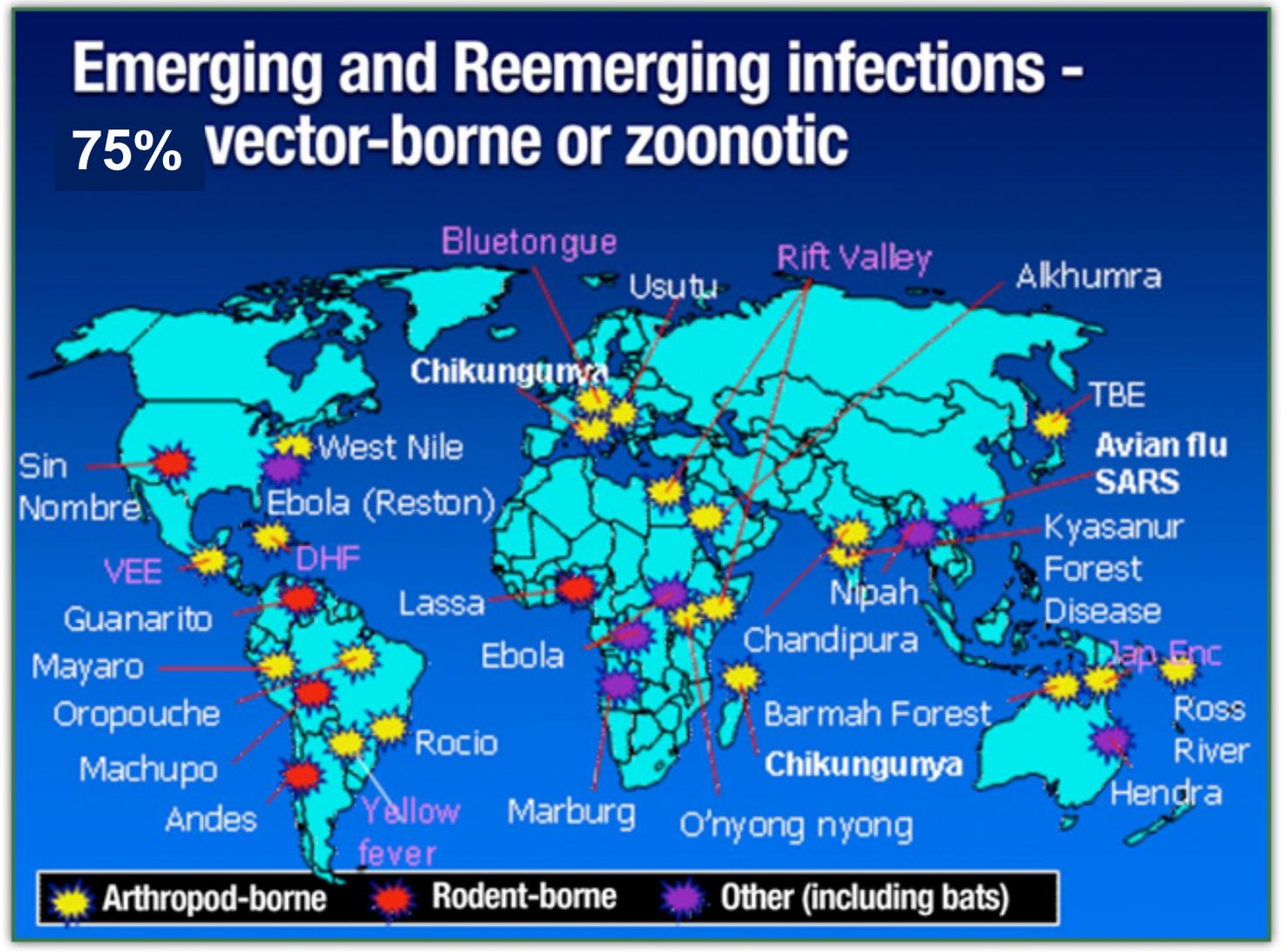
## Setting the stage...

One Health video clip (3.0 min): <https://www.youtube.com/watch?v=2pyLm2j3jxl&feature=youtu.be>

➤ CDC One Health video clip (2.5 min): <https://www.youtube.com/watch?v=TG0pduAYESA>

Additional information is available from the PBS documentary entitled *Spillover* (55.56 min): <http://www.pbs.org/spillover-zika-ebola-beyond/home/>

Emerging & Re-emerging infections - Zika Virus is the next arthropod-borne infection to be added to the map.



# Zika Virus – Exemplifies “One Health”

11

The One Health approach brings together entomologists, physicians, veterinarians, virologists, wild life biologists, environmental experts, universities, governments, public health organizations, world health organizations, just to mention a few... all seeking to help address the following needs:

- Zika virus infection is usually asymptomatic or causes mild illness (e.g. fever, rash, muscle/joint pain), however, CDC has recently concluded that Zika virus infection during pregnancy can cause microcephaly and other severe fetal brain defects. Association with autoimmune-like illnesses such as Guillain-Barre syndrome is under investigation.
- Commercial vaccines and specific antiviral drug treatment for Zika virus infection are needed. Funding for basic research and vaccine/drug development is required.
- Diagnostic tests for Zika virus (e.g. blood, urine or saliva samples) need to be developed and then approved by the FDA.

# Zika Virus – Exemplifies “One Health” cont’d

12

- Mosquito (*Aedes* genus) vector control needs focused intervention (e.g. removal of water-containing sources; insecticide sprays; utilizing genetic engineering mosquitoes to suppress the mosquito population); risk communication/education to help the public avoid mosquito exposure.
- Enhanced surveillance systems are needed; take advantage of apps via smartphones; collecting and analyzing data to assist with public health strategies.
- Determining whether there are non-human reservoirs for Zika virus needs to be established; studying the viral strains may help explain why the virus has demonstrated the capacity to spread exponentially in the human population in the Americas.
- Medical care of new born infants with microcephaly is needed which means assessing the medical infrastructure at local and national levels; financial commitment; government engagement; policy development at local, national, international levels.



# A few examples of Mosquito borne diseases



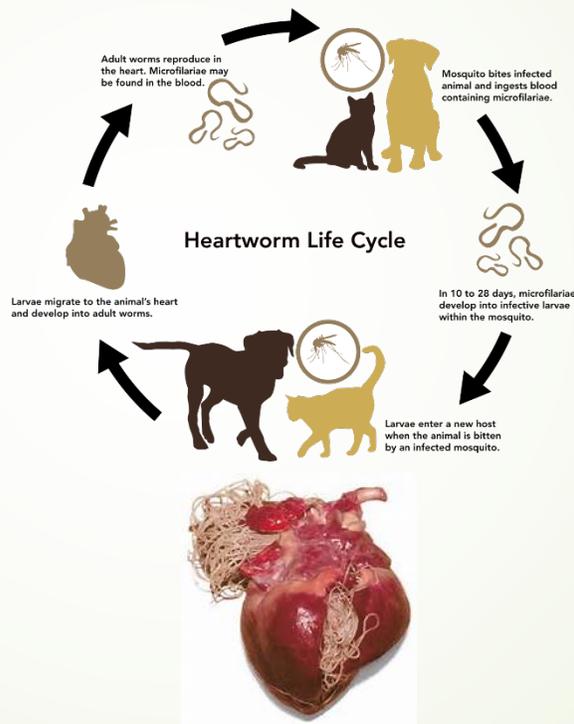
*Aedes aegypti* mosquito transmits Dengue, Chikungunya, **Yellow fever**, and Zika viruses.



Asian Tiger (*Aedes albopictus*) transmits West Nile virus, Equine Encephalitis virus.



*Culex tritaeniorhynchus* transmits Japanese encephalitis virus.



Mosquito transmitted Zika virus can cause microcephaly.



*Anopheles* sp. transmits **malaria** (*Plasmodium falciparum*).

Mosquito transmitted *Dirofilaria immitis* heartworm larvae. (*Aedes aegypti*, *Aedes albopictus*, *Aedes canadensis*, *Aedes sierrensis*, *Aedes trivitattus*, *Aedes vexans*, *Anopheles punctipennis*, *Anopheles quadrimaculatus*, and *Culex quinquefasciatus*.)

# Lyme Disease is on the rise...

14



Ixodes tick (deer tick) nymph



Rash may or may not develop.



Lyme Disease is caused by a spirochete - a corkscrew-shaped bacterium called *Borrelia burgdorferi* transmitted by Ixodes ticks.

**Shorter winters and increased temperatures enhance tick survival.**

Lyme disease is a Nationally Notifiable Disease to the CDC.

<https://wwwn.cdc.gov/nndss/>

Primarily people & dogs get Lyme Disease but other animals can become infected (horses, deer, cattle, cats (rarely) & mice). Known as the “great imitator” because it mimics other diseases.

People: flu-like illness (fever, chills, sweats, muscle aches, fatigue, nausea and joint pain); early & chronic forms.

Dogs & horses: shifting leg lameness, swollen joints, lethargy, fever and anorexia.

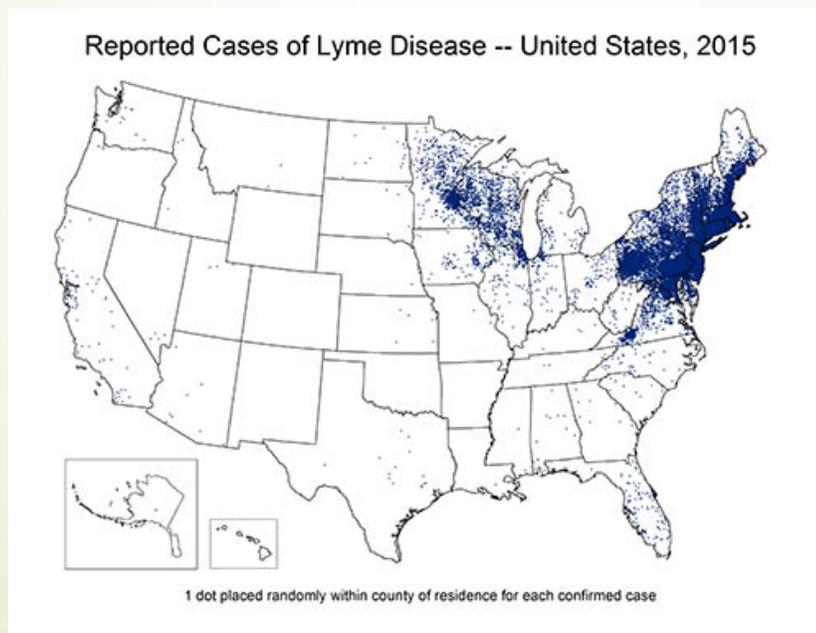
Prevention: a vaccine is available for dogs.

Treatment: typically antibiotics (e.g. doxycycline) are prescribed for people, dogs and horses.

<https://www.niaid.nih.gov/diseases-conditions/lyme-disease>

# Lyme disease, cont'd

- ▶ 1. Lyme disease CDC: <https://www.cdc.gov/lyme/index.html>
- ▶ 2. Data and Statistics (Tables, Graphs, Maps): <https://www.cdc.gov/lyme/stats/index.html>
- ▶ 3. Overview of Surveillance and Data (Limitations of surveillance data and publicly available surveillance data): <https://www.cdc.gov/lyme/stats/survfaq.html>
- ▶ 4. County-level Lyme Disease data (Excel spread sheet): <https://www.cdc.gov/lyme/resources/ld-case-counts-by-county-00-15.csv>



# Emerging Diseases of Global Health and Agricultural Concerns – Links Between Animal and Human Health

16

Middle East Respiratory Syndrome (2012)



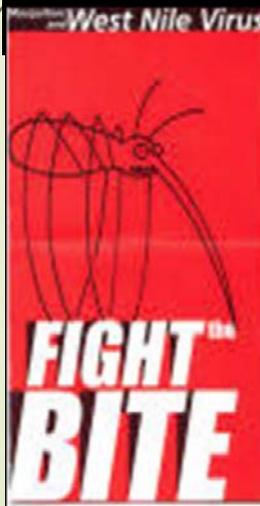
Ebola Outbreak (2014)



Severe Acute Respiratory Syndrome (2003)



H1N1 Influenza (2009)



West Nile Virus (1999)



Bovine Spongiform Encephalitis (1986)



Escherichia coli -O157:H7 (1998)



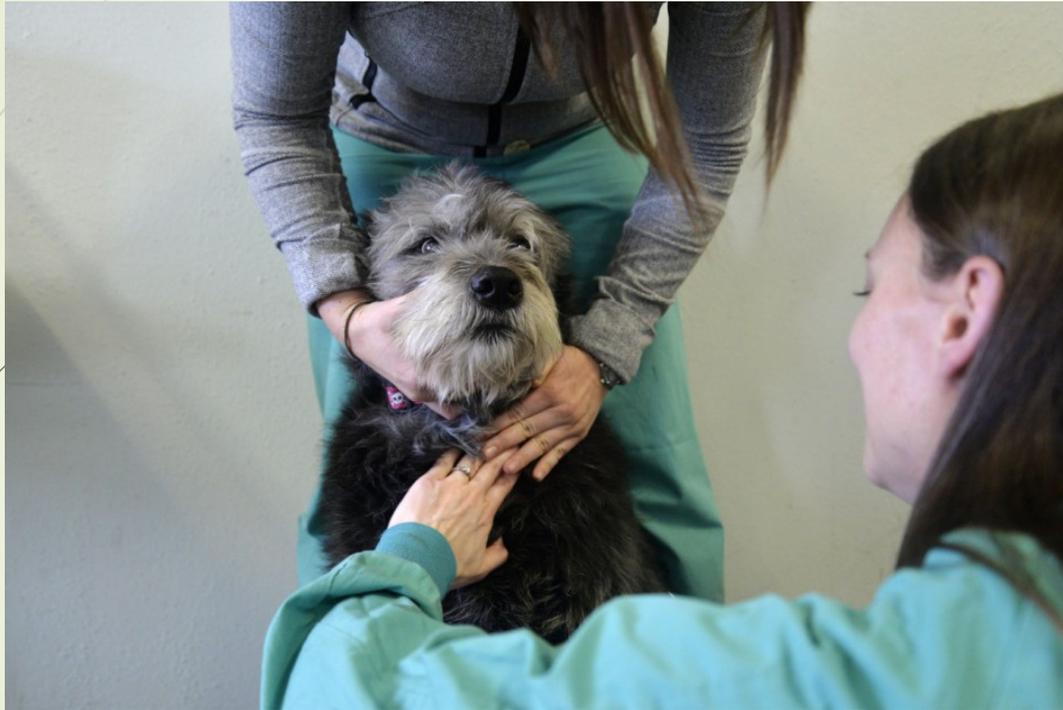
{Slide courtesy of Marguerite Pappaioanou, DVM, MPVM, PhD}

# Animals as Sentinels

17

## Free lead testing event for dogs in Flint water crisis

[http://www.mlive.com/news/flint/index.ssf/2016/04/free\\_lead\\_testing\\_event\\_for\\_do.html](http://www.mlive.com/news/flint/index.ssf/2016/04/free_lead_testing_event_for_do.html)



Maggie, a terrier mix, is held by Michigan State University veterinary student Courtney Andries, of East Lansing, while veterinary technician Monica Reinke, of East Lansing, finishes drawing her blood during a free lead testing event for animals on Saturday, March 19, 2016 at the parish hall of St. Paul's Episcopal Church in Flint. The event was held by the Michigan State College of Veterinary Medicine amid Flint's water crisis.

*Rachel Woolf | MLive.com*

The test will not only check for lead but for other metals including copper, iron, mercury and zinc. More than 170 dogs have been tested during the previous three events.

There have been five cases of dogs that tested positive for lead.

Issues that can arise in dogs exposed to lead include the gastrointestinal system, with decreased appetite, vomiting and diarrhea.

Brain involvement can be impacted, with dogs becoming easily agitated or showing signs of seizures, along with a potential drop in red blood cell or abnormal development of cells.

# Lead poisoning in Northern Nigeria 2010

18

- Early 2010 ducks began to disappear in Zamfara, Nigeria no one thought it was important at the time.
- By May 2010 hundreds of children became sick (vomiting, headaches & seizures)... and many died. Cause unknown.
- Public health team sent in to investigate (CDC/Nigeria/WHO/Doctors Without Borders/and an Animal-Human Interface Officer).
- Villagers reported  $\frac{1}{4}$  of all children in their communities had died.
- Found unsafe levels of **LEAD** inside homes, water and the soil... children had dangerous levels of lead in their blood.
- Missed the clue that the deaths of the ducks could have alerted health officials of the crisis earlier... ducks were sentinels of an environmental hazard.
- Recent mining for gold... no protective equipment; often brought rocks inside the homes to extract the gold; children were exposed to lead dust from the rocks.



Children sit on bags of lead-contaminated soil, which were removed from their village of Zamfara during cleanup.

Bottom Line: Largest known outbreak of Lead Poisoning in history!

**355 cases: 163 deaths with 111 deaths of children.**

# White-nose Syndrome in Bats – loss of pollinators

19



Research projects are focused on managing WNS - identifying a biological control agent for the fungus is key.

Active collaboration with scientists, managers, lawmakers and the public is needed to address WNS via a **One Health** approach!

White-nose Syndrome (WNS) is a disease caused by the **fungus *Pseudogymnoascus destructans***. The disease is estimated to have killed over six million bats in eastern North America since 2006, and can kill up to 100% of bats in a colony during hibernation. The disease is caused by a fungus from Eurasia, which was accidentally transported here by humans. There are no antifungal vaccines.

## Bats are important for:

- a. **Pest control** - the primary predators of night-flying insects including many damaging agricultural pests.
- b. **Pollination** – from deserts to rainforests, nectar-feeding bats are critical pollinators for a wide variety of plants of great economic and ecological value.
- c. **Seed dispersion** – fruit eating bats scatter seeds helping to restore forests.

We can expect to see significant ecosystem changes in the coming years following the loss of the bat population!

[https://www.nwhc.usgs.gov/disease\\_information/white-nose\\_syndrome/](https://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/)

[https://www.whitenosesyndrome.org/sites/default/files/resource/blehert\\_et\\_al\\_2008\\_wns\\_fungus\\_total.pdf](https://www.whitenosesyndrome.org/sites/default/files/resource/blehert_et_al_2008_wns_fungus_total.pdf)

# Honey Bees - Loss of pollinators continues.

20



Honey bees in hive.



Varroa mites on a bee.



Nation's beekeepers lost 44% of bee colonies in 2015-16.

(Survey by Bee Informed Partnership - Univ. Maryland 5-10-16; USDA Report 5-12-16)

A variety of factors may be the cause: pesticides, Nosema (a disease causing fungus), the Varroa mite, and changing land use patterns.

**Varroa destructor** is an external parasitic mite that attacks the honey bee *Apis cerana* and *Apis mellifera*. It feeds on the hemolymph, weakens the bee and enables infection by harmful pathogens such as viruses, bacteria or fungus to develop.

**Colony Collapse Disorder** – loss of worker bees with few dead bees near the hive; queen bee and brood remain.

2015 the White House released a “**National Strategy to Promote The Health of Honey Bees and Other Pollinators**”.

[<https://www.whitehouse.gov/blog/2015/05/19/announcing-new-steps-promote-pollinator-health>]

Honey bees pollinate crops such as apples, cranberries, melons, broccoli, blueberries, cherries... and almonds depend entirely on honey bees for pollination. (<http://www.abfnet.org>)

# Marine Environmental Sentinels...

21



Healthy Green Sea Turtle



Healthy coral reef



Fibropapillomatosis in a Green Sea Turtle (can obstruct swimming, feeding, buoyancy, sight, and can lead to death). There is a strong link between this disease and the environmental health of the coastal habitat. [<http://www.cabi.org/isc/datasheet/82638>]



Unhealthy reef associated with oceanic acidification

[[http://coralreef.noaa.gov/education/oa/resources/22-4\\_kleypas.pdf](http://coralreef.noaa.gov/education/oa/resources/22-4_kleypas.pdf)]

**Climate Change...** Paris Climate Conference 12-12-2015 - 195 countries adopted a global climate deal to limit global warming to  $< 2^{\circ}\text{C}$ . Ratified by 75 countries on 10-7-2016.

22

Meeting of the Parties to the Montreal Protocol on 10-15-2016 in Kigali, Rwanda 197 countries agreed to reduce use of hydrofluorocarbons (HFCs), powerful greenhouse gases. Complete elimination of HFCs by the year 2050 is estimated to prevent a  $0.5^{\circ}\text{C}$  rise in global temperatures by the end of this century.



Tornados & Hurricanes



Floods



Red Tide Algae Blooms



Rising sea levels



Floods



Air Pollution



Melting Glaciers and Ice fields



Wild Fires



Droughts

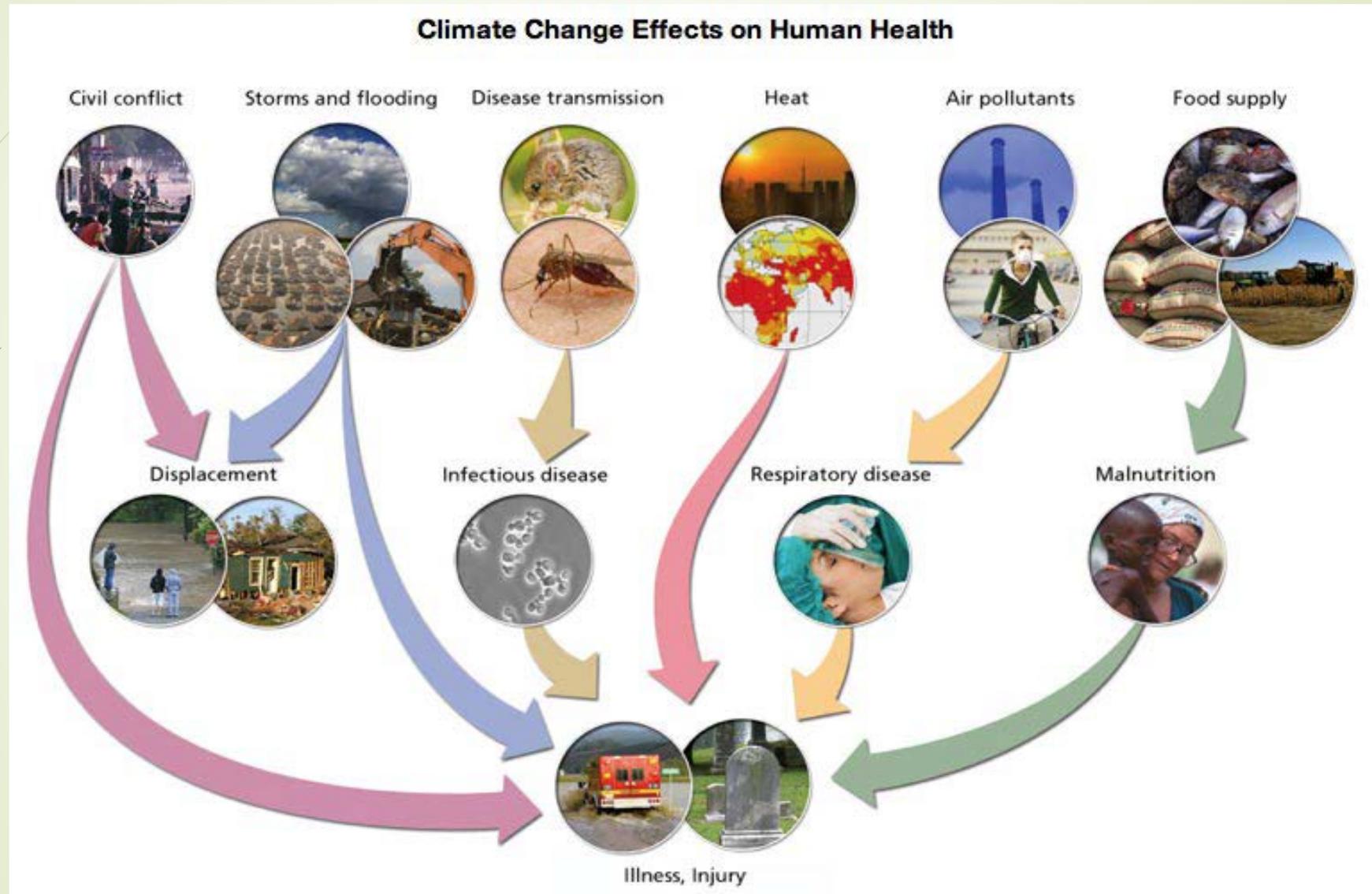
	Climate Driver	Exposure	Health Outcome	Impact
 <b>Extreme Heat</b>	More frequent, severe, prolonged heat events	Elevated temperatures	Heat-related death and illness	Rising temperatures will lead to an increase in heat-related deaths and illnesses.
 <b>Outdoor Air Quality</b>	Increasing temperatures and changing precipitation patterns	Worsened air quality (ozone, particulate matter, and higher pollen counts)	Premature death, acute and chronic cardiovascular and respiratory illnesses	Rising temperatures and wildfires and decreasing precipitation will lead to increases in ozone and particulate matter, elevating the risks of cardiovascular and respiratory illnesses and death.
 <b>Flooding</b>	Rising sea level and more frequent or intense extreme precipitation, hurricanes, and storm surge events	Contaminated water, debris, and disruptions to essential infrastructure	Drowning, injuries, mental health consequences, gastrointestinal and other illness	Increased coastal and inland flooding exposes populations to a range of negative health impacts before, during, and after events.
 <b>Vector-Borne Infection</b> (Lyme Disease)	Changes in temperature extremes and seasonal weather patterns	Earlier and geographically expanded tick activity	Lyme disease	Ticks will show earlier seasonal activity and a generally northward range expansion, increasing risk of human exposure to Lyme disease-causing bacteria.
 <b>Water-Related Infection</b> ( <i>Vibrio vulnificus</i> )	Rising sea surface temperature, changes in precipitation and runoff affecting coastal salinity	Recreational water or shellfish contaminated with <i>Vibrio vulnificus</i>	<i>Vibrio vulnificus</i> induced diarrhea & intestinal illness, wound and bloodstream infections, death	Increases in water temperatures will alter timing and location of <i>Vibrio vulnificus</i> growth, increasing exposure and risk of water-borne illness.
 <b>Food-Related Infection</b> ( <i>Salmonella</i> )	Increases in temperature, humidity, and season length	Increased growth of pathogens, seasonal shifts in incidence of <i>Salmonella</i> exposure	<i>Salmonella</i> infection, gastrointestinal outbreaks	Rising temperatures increase <i>Salmonella</i> prevalence in food; longer seasons and warming winters increase risk of exposure and infection.
 <b>Mental Health and Well-Being</b>	Climate change impacts, especially extreme weather	Level of exposure to traumatic events, like disasters	Distress, grief, behavioral health disorders, social impacts, resilience	Changes in exposure to climate- or weather-related disasters cause or exacerbate stress and mental health consequences, with greater risk for certain populations.

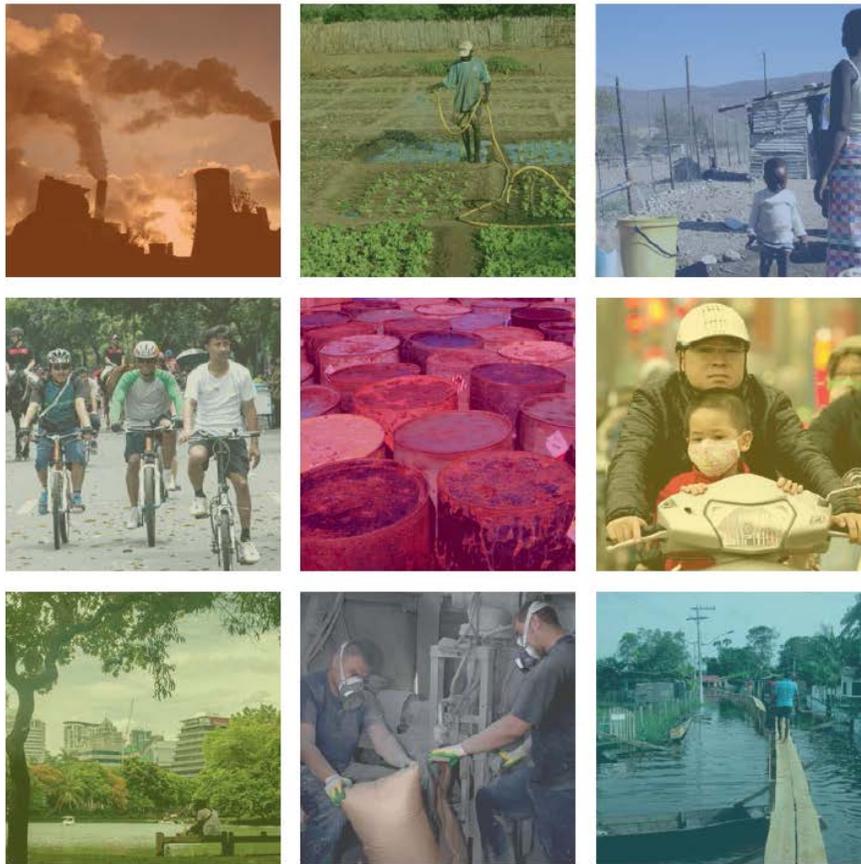
## Examples of Climate Impacts on Human Health

Source: U.S. Global Change Research Program

<http://globalchange.gov/>

We are at an important crossroad to shift U.S. thinking...  
One Health can appeal to people at a personal level.





## PREVENTING DISEASE THROUGH HEALTHY ENVIRONMENTS

A global assessment of the burden of disease from environmental risks

A Prüss-Ustün, J Wolf, C Corvalán, R Bos and M Neira

2016



## Disease CAN be prevented through healthier environments!

The realization of just how much disease and ill health can be prevented by focusing on environmental risk factors should add impetus to global efforts to encourage preventive measures through all available policies, strategies, interventions, technologies and knowledge.

The analysis shows that 23% of global deaths (and 26% of deaths among children under five, which equates to 1.7 M deaths) are due to modifiable environmental factors – and therefore can be prevented... **e.g. reduce air pollution; access to safe water; access to basic sanitation; and access to clean fuel.**

# Translational Biology... advancing One Health.

- The **Institute of Medicine** (now the National Academy of Medicine)– Held a workshop in June 2015 entitled *The Role of Clinical Studies for Pets with Naturally Occurring Tumors in Translational Cancer Research* to examine the rationale and potential for an integrated comparative clinical trial approach to cancer drug development.

<https://www.nap.edu/catalog/21830/the-role-of-clinical-studies-for-pets-with-naturally-occurring-tumors-in-translational-cancer-research>

- **National Cancer Institute - Comparative Oncology Trials Consortium (NCI-COTC)**  
Established to provide the infrastructure and resources needed to integrate clinical trials for pets with naturally occurring cancers into the development pathways for new drugs, devices, and imaging techniques for human cancers... while benefitting the lives of our pets.
- Currently **20 academic comparative oncology centers** are actively engaged in the NCI-COTC.

<https://ccrod.cancer.gov/confluence/display/CCRCOPWeb/Comparative+Oncology+Trials+Consortium>

## Canine tumors share similarities with human cancers in histologic appearance, tumor genetics, biologic behavior, molecular targets, therapeutic response, heterogeneity, acquired resistance, recurrence, and metastasis.



Dr. Rodney Page, Director, Flint Animal Cancer Center Colorado State University & NCI-COTC member. He lead the partnership with the IOM Workshop.



Scottish Terriers are 19 more times more likely to develop bladder cancer (Transitional Cell Carcinoma - BRAF gene mutation) than the average dog breed, accounts for 2% of all canine tumors and can affect up to 20,000 pets each year; this rate is similar to that seen in humans.



Human-femur osteosarcoma

The gene expression profiles for canine and human osteosarcoma are indistinguishable, suggesting that findings from clinical trials for dogs with that type of cancer would be informative for human patients with osteosarcoma.



Canine-radius & ulnar osteosarcoma



Why do elephants rarely develop cancer? Possibly because they have at least 20 copies (40 alleles) of TP53 (encodes for the protein p53), a crucial tumor suppressor gene, while humans only have 1 copy (2 alleles)... a look at evolutionary-based medicine. (Abegglen, L. et al. JAMA 10-8-15)

# NCI Funded Canine Supplements

*“The answer to cancer may be walking beside us...”*

28

17 applications were received.

8 funded: scored in the Exceptional and Outstanding range.

The 8 applications covered studies in all 6 canine tumors.

[https://www.youtube.com/watch?v=02bYBJc\\_yKo](https://www.youtube.com/watch?v=02bYBJc_yKo)

Institution(s)	Project Leader	Canine Cancer(s)	Title or Aims
Baylor College of Medicine/U. Florida Vet Med College/ Texas A&M/Tech U. Denmark	Jonathan Levitt, PhD/ Alan Herron, DVM	Bladder, Mammary, Melanoma	Mutational load and predicted neoantigens in canine tumors and characterization of immune infiltrate and the tumor microenvironment
U. Colorado/Colorado State U. Vet School	Jill Slansky, PhD/ Steven Dow, DVM, PhD	B-Cell Lymphoma	Immune profiling and neoantigen discovery in canine B cell lymphoma
DFCI-HCC/Tufts University Vet Med School	Katherine Janeway, MD/ Cheryl London, DVM	Osteosarcoma	A multi-institutional approach to interrogate and improve immunotherapy outcomes in osteosarcoma
Purdue University/Duke University	Deborah Knapp, DVM/ H. Kim Lyerly, MD	Bladder	Advancing immunology in dogs with naturally-occurring invasive bladder cancer: a relevant model to improve immunotherapy across molecular cancer subtypes in humans
Roswell Park Cancer Inst. /Cornell U. Vet Med	Richard Koya, MD, PhD/Kristy Richards, PhD, MD	B-Cell Lymphoma	Immunogenic mutational load analysis for adoptive T cell therapy in canine B cell lymphoma
UC Davis/UC Davis School of Vet Med	Arta Monjazeb, MD, PhD	Glioma, Melanoma, Osteosarcoma	Evaluation of the tumor mutational landscape/neoantigens and immunophenotyping the tumor microenvironment in canine cancers
Ohio State U/OSU Vet Med School/TGEN	Peter Shields, MD/ Jeffrey Trent, PhD	Melanoma, Osteosarcoma	Immunogenomic profiling of canine melanoma and osteosarcoma
MD Anderson CC/Texas A&M	Amy Heimberger, MD/ Jonathan Levine, DVM	Glioma	Genomic and immunological canine glioma characterization

## FDA Warns of Illnesses and Deaths in Pets Exposed to Prescription Topical (Human) Cancer Treatment: Fluorouracil Jan. 18, 2017

- ▶ Pets are at risk of illness and death when exposed to the topical cancer medication Fluorouracil Cream USP 5% (5-FU.) intended for use in people. Fluorouracil may also be marketed under the brand names Carac, Effudex and Fluoroplex.
- ▶ People using this medication should use care when applying and storing the medication if they are also in a household with pets, as even very small amounts could be dangerous to these animals.
- ▶ The FDA has received reports of five dogs that became ill and died after accidentally ingesting the topical cream.
  - ▶ In one case, two dogs began playing with a tube of Fluorouracil and one punctured the tube before their owner could retrieve it. Within 2 hours, the dog that punctured the tube began vomiting, experienced seizures, and died 12 hours later.
  - ▶ In a separate case, a dog located his owner's tube of Fluorouracil and ingested its contents. The owner realized the dog had ingested the medication and rushed him to the veterinarian. The veterinarian attempted treatment, but the dog's condition declined over three days and he was ultimately euthanized.

## Fluorouracil warning - Jan. 18, 2017 cont'd

- ▶ Although the FDA has not to date received any reports involving cats, they are also expected to be extremely sensitive to Fluorouracil cream. If an owner applies Fluorouracil cream to an afflicted area and touches their cat, the cat may accidentally ingest the medication when grooming itself and suffer adverse events.
- ▶ The FDA recommends that people who use Fluorouracil take care to prevent their pets from accidentally ingesting the medication.
  - ▶ Store all medications safely out of the reach of pets.
  - ▶ Safely discard or clean any cloth or applicator that may retain medication and avoid leaving any residues of the medication on hands, clothing, carpeting or furniture.
  - ▶ Consult your health care provider on whether it is appropriate to cover the treated area.
  - ▶ If you are using topical medications containing Fluorouracil and your pet becomes exposed, consult a veterinarian immediately.
  - ▶ If your pet shows signs such as vomiting, seizing or other illness, seek immediate veterinary care for your pet and be sure to provide the details of the exposure.

## Fluorouracil warning – Jan. 18, 2017 cont'd

- ▶ Veterinarians who have patients who show signs such as vomiting, seizing or other illness should ask whether anyone in the household has used topical chemotherapy containing Fluorouracil.
- ▶ Health care providers who prescribe topical cancer medications containing Fluorouracil and pharmacists who fill these prescriptions should advise patients with pets to take care to prevent exposure of the pet to the medication.
- ▶ Pet owners and veterinarians can also [report any adverse events to the FDA](http://www.fda.gov/AnimalVeterinary/NewsEvents/CVMUpdates/ucm537434.htm), by following the link to the Form FDA 1932a.

<http://www.fda.gov/AnimalVeterinary/NewsEvents/CVMUpdates/ucm537434.htm>



## FDA Warns of Illnesses & Deaths in Pets Exposed to Prescription Topical Pain Medications Containing Flurbiprofen April 17, 2015

- ▶ Pets are at risk of illness and death when exposed to topical pain medications containing the nonsteroidal anti-inflammatory drug (NSAID) flurbiprofen.
- ▶ People using these medications, should use care when applying them in a household with pets, as even very small amounts could be dangerous to these animals.
- ▶ The FDA has received reports of cats in two households that became ill or died after their owners used topical medications containing flurbiprofen on themselves to treat muscle, joint, or other pain.
  - ▶ The pet owners had applied the cream or lotion to their own neck or feet, and not directly to the pet, and it is not known exactly how the cats became exposed to the medication.
  - ▶ The products contained the NSAID flurbiprofen and the muscle relaxer cyclobenzaprine, as well as other varying active ingredients, including baclofen, gabapentin, lidocaine, or prilocaine.

# Flurbiprofen warning - April 17, 2015 cont'd

33

- ▶ Two cats in one household developed kidney failure and recovered with veterinary care. Two cats in a second household developed signs that included reluctance to eat, lethargy, vomiting, melena (black, tarry, bloody stools), anemia, and dilute urine. These two cats died despite veterinary care. A third cat in the second household also died after the owner had stopped using the medication. Veterinarians performed necropsies on the three cats that died and found evidence in the kidneys and intestines that were consistent with NSAID toxicity.
- ▶ The FDA recommends that people who use topical medications containing flurbiprofen take care to prevent their pets from being exposed to them, even in ways that may seem unlikely to cause problems.
  - ▶ Store all medications safely out of the reach of pets.
  - ▶ Safely discard or clean any cloth or applicator that may retain medication and avoid leaving any residues of the medication on clothing, carpeting or furniture.
  - ▶ Consult your health care provider on whether it is appropriate to cover the treated area.
  - ▶ If you are using topical medications containing flurbiprofen and your pet becomes exposed, bathe or clean your pet as thoroughly as possible and consult a veterinarian.
  - ▶ If your pet shows signs such as lethargy, lack of appetite, vomiting, or other illness, seek veterinary care for your pet and be sure to provide the details of the exposure.
  - ▶ Understand that, although the FDA has not received reports of dogs or other pets becoming sick in relation to the use of topical pain medications containing flurbiprofen, these animals may also be vulnerable to NSAID toxicity after being exposed to these medications.

# Flurbiprofen warning – April 17, 2015 cont'd

34

- ▶ **Veterinarians** who have patients who show signs of NSAID toxicity should ask whether anyone in the household has used topical pain medications containing flurbiprofen. **Health care providers** who prescribe topical pain medications containing flurbiprofen and pharmacists who fill these prescriptions should advise patients with pets to take care to prevent exposure of the pet to the medication. **Pet owners** and veterinarians can also [report any adverse events to the FDA](#).

<http://www.fda.gov/AnimalVeterinary/NewsEvents/CVMUpdates/ucm443333.htm>

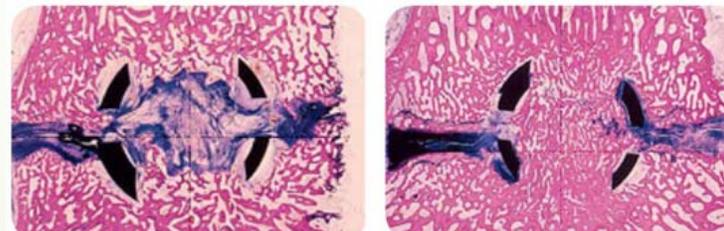


# Craniofacial reconstruction through regenerative technology. One Health benefits for animals and people.

35

**Case example:** Dogs with a malignant or benign tumor of the jaw (mandible) often undergo surgery to remove a section of the diseased jaw (mandibulectomies); or in the case of trauma (e.g. car accidents) reconstruction of the jaw is needed in order to restore function.

- ▶ In the past, bone grafts were used but the results were far from ideal.
- ▶ FDA has approved 2 spinal fusion products for use in people consisting of **recombinant human bone morphogenetic proteins (rh-BMPs)** which are growth factors that help induce formation of bone and cartilage.
- ▶ Using titanium locking plates as a scaffold, rh-BMPs are combined with a collagen and calcium compression resistant matrix to achieve predictable and timely bone regeneration/reconstruction of the jaw.



Collagen

Collagen + rh-BMP



Craniofacial Disorders  
and Solutions in Man and Animals

Los Angeles, CA  
November 11-13, 2016

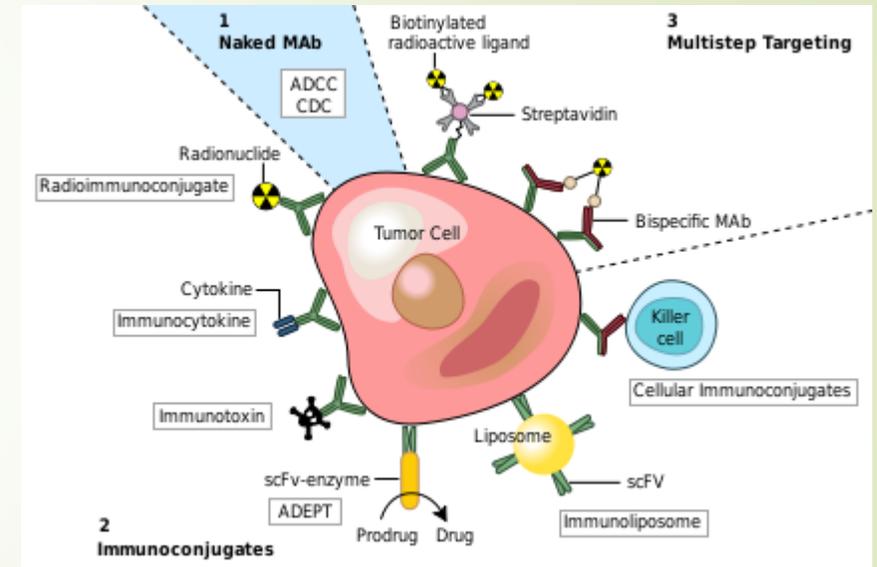


(Frank J.M. Verstraete, Boaz Arzi, Daniel J. Huey, Derek D. Cissell and Kyriacos A. Athanasiou 2015 <http://onlinelibrary.wiley.com/doi/10.1111/j.1532-950X.2014.12123.x/epdf>)

# Therapeutic Monoclonal Antibodies (mAbs)

In both human and veterinary medicine mAbs have therapeutic applications:

- Asthma
- Dust mite IgE hypersensitivity
- Osteoarthritis
- B-cell lymphoma
- Autoimmune disease
- Allergic diseases and pruritis



**Monoclonal antibodies for cancer.** **ADEPT:** antibody directed enzyme prodrug therapy; **ADCC:** antibody dependent cell-mediated cytotoxicity; CDC: **complement-dependent cytotoxicity**; MAb: monoclonal antibody; scFv, single-chain Fv fragment.<sup>[40]</sup>

# Recent therapies approved by FDA-CVM

37

- ▶ **Tanovea-CA1** - “Conditionally approved” (rabacfosadine for intravenous injection) for treating canine lymphoma.
- ▶ **Intrafungol** (itraconazole oral solution) for cats with ring worm (*Microsporum canis*) a zoonotic disease. <https://www.fda.gov/AnimalVeterinary/NewsEvents/CVMUpdates/ucm528537.htm>
- ▶ **Nocita** (bupivacaine liposome injectable suspension), a new animal drug that provides post-operative pain relief for knee surgery in dogs.  
<https://www.fda.gov/AnimalVeterinary/NewsEvents/CVMUpdates/ucm516857.htm>
- ▶ **Entyce** (capromorelin oral solution), a new animal drug indicated for appetite stimulation in dogs. Entyce is a selective ghrelin receptor agonist that binds to receptors that stimulate appetite. <https://www.fda.gov/AnimalVeterinary/NewsEvents/CVMUpdates/ucm505031.htm>
- ▶ **Galliprant** (grapiprant tablets), a new animal drug intended to control pain and inflammation associated with osteoarthritis in dogs. It is a prostaglandin E<sub>2</sub> (PGE<sub>2</sub>) EP4 receptor antagonist; a non-cyclooxygenase inhibiting, non steroidal anti-inflammatory drug (NSAID). <https://www.fda.gov/AnimalVeterinary/NewsEvents/CVMUpdates/ucm491552.htm>

# Canine, Feline, and Human Obesity

38

**Health risk problems include: Type 2 diabetes\*, cardiorespiratory disease, musculoskeletal, and cancer.** \*Global public health issue – Diabetes has quadrupled world wide since 1980... today there are 422 million adults living with diabetes. (<http://who.int/mediacentre/news/releases/2016/world-health-day/en/#>)



**Optimal health for both humans and animals includes: Healthy Diets and Exercise.**



# The Epidemic of Obesity and Type 2 Diabetes

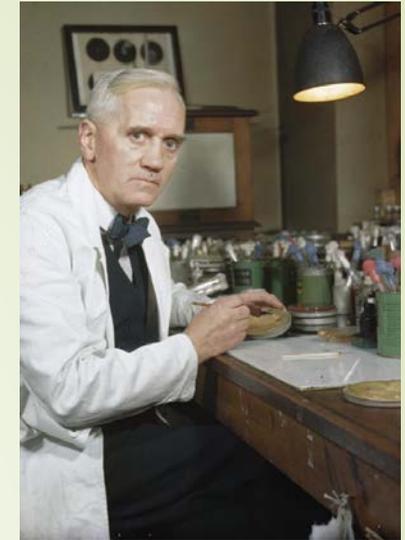
39

National Academy of Medicine, 10-17-2016 - Key note by **Dr. Margaret Chan**, Director General, World Health Organization. [[Lancet - http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(16\)30054-X.pdf](http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(16)30054-X.pdf)]

- World wide, diabetes has cost \$673 billion in 2015.
- If the post-2000 trends continue, the probability of meeting the global obesity target is virtually zero, *i.e* halting by 2025 the rise in obesity at its 2010 levels. By 2025, global obesity could reach 18% in men and 21% in women.
- The obesity epidemic will not be reversed without government leadership.
- Food industries – the production of highly processed foods, inexpensive junk foods and sugary beverages needs to be addressed through healthy food policies.
  
- **MISSOURI Data Portal:** The data portal was developed to provide a convenient access point for health-related data for Missouri. This portal is a comprehensive source for community health assessment, public, and population health data. Each data portal page provides interactive data at the most granular level available. [http://ephtn.dhss.mo.gov/EPHTN\\_Data\\_Portal/](http://ephtn.dhss.mo.gov/EPHTN_Data_Portal/)
- See the Section on **Chronic Disease for Diabetes Type II** in Missouri: <http://health.mo.gov/living/healthcondiseases/chronic/diabetes/index.php>
- **2016 Banfield State of Pet Health Report:** <https://www.banfield.com/Banfield/media/PDF/Downloads/soph/Banfield-State-of-Pet-Health-Report-2016.pdf>

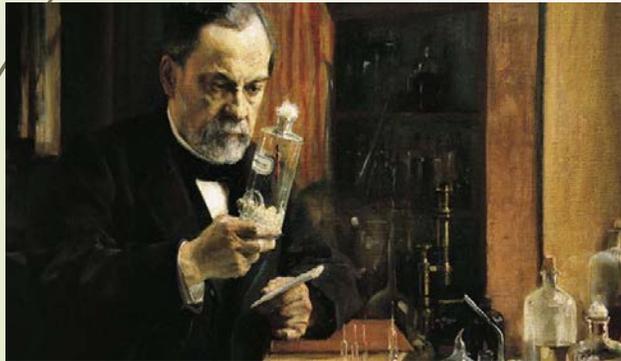
## Sir Alexander Fleming (1881 - 1955)

- 1928 discovered penicillin
- 1944 knighted
- 1945 awarded the Nobel Prize



Dr. Fleming cautioned that:

**“Resistance is a natural counterpart to antibiotics.”**



## Louis Pasteur (1822 - 1895)

- Developed germ theory
- Created pasteurization
- Created vaccines for anthrax & rabies
- Developed fermentation

*“Messieurs, c’est les microbes qui auront le dernier mot.” Louis Pasteur*

**“Gentlemen, it is the microbes who will have the last word.”**

# National Strategy on Combating Antibiotic Resistant Bacteria

The National Strategy outlines 5 Goals and Objectives:

1. Slow the emergence of resistant bacteria and prevent the spread of resistant infections.
2. Strengthen National **One-Health** surveillance efforts to combat resistance.
3. Advance development and use of rapid diagnostic tests for identification and characterization of resistant bacteria.
4. Accelerate basic and applied research and development for new antibiotics, other therapeutics and vaccines.
5. Improve international collaboration and capacities for antibiotic resistance prevention, surveillance, control, and antibiotic research and development.

# WHO-OIE-FAO 2015 Global Action Plan on AMR

42

- ▶ **Objective 1: Improve** awareness and understanding of antimicrobial resistance through effective communication, education and training.
- ▶ **Objective 2: Strengthen** the knowledge and evidence base through surveillance and research.
- ▶ **Objective 3: Reduce** the incidence of infection through effective sanitation, hygiene and infection prevention measures.
- ▶ **Objective 4: Optimize** the use of antimicrobial medicines in human and animal health.
- ▶ **Objective 5: Develop** the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.

*[May 2015 - World Health Assembly adopted this Global Action Plan on AMR]*

<http://www.who.int/antimicrobial-resistance/en/>



**WORLD ORGANISATION  
FOR ANIMAL HEALTH**



# United Nations – High level meeting on AMR

43



**GLOBAL ACTION PLAN**  
ON ANTIMICROBIAL  
RESISTANCE



- ▶ United Nations held a high-level meeting on antimicrobial resistance on 9-21-2016.
- ▶ The members countries embraced the 2015 Global Action plan on AMR.
- ▶ ... “Support a multi-sectoral and **One Health approach** to address antimicrobial resistance, including through public health-driven capacity-building activities and innovative public-private partnerships and incentives and funding initiatives, together with relevant stakeholders in civil society, industry, small- and medium sized enterprises, research institutes and academia, to promote access to quality, safe, efficacious, and affordable new medicines and vaccines, especially antibiotics, and; alternative therapies and medicines to treatment with antimicrobials, and other combined therapies, vaccines and diagnostic tests; ...”

[<http://www.un.org/pga/71/wp-content/uploads/sites/40/2016/09/Draft-AMR-Declaration.pdf>]

[<http://www.un.org/pga/71/2016/09/21/press-release-hl-meeting-on-antimicrobial-resistance/>]

# Minnesota Department of Health develops a One Health Antibiotic Stewardship Collaborative Five-Year Strategic Plan



Home Page: <http://www.health.state.mn.us/onehealthabx/>

Current State Plan Progress and Data: <http://www.health.state.mn.us/onehealthabx/plan.html>

- An antibiogram is a compilation of antimicrobial susceptibilities of selected pathogens. In Minnesota, they have a human antibiogram of isolates from the Minnesota Department of Health Public Health Laboratory and an animal antibiogram of isolates from the University of Minnesota Veterinary Medical Center.

Antibiograms can serve as valuable tools in guiding therapy choices.

- Human Antibiogram:  
[Antimicrobial Susceptibilities of Selected Pathogens](#)
- Companion animal antibiogram:  
[VMC Antibiogram \(PDF\)](#)
- Banfield Pet Hospital - Antimicrobial Usage Patterns Among Companion Animal Veterinarians - 2017 [https://www.banfield.com/getmedia/e6c50f42-9ded-4323-aa03-4fd92a2aa012/VET-Report\\_Final\\_web.pdf](https://www.banfield.com/getmedia/e6c50f42-9ded-4323-aa03-4fd92a2aa012/VET-Report_Final_web.pdf)

# World Veterinary Day

## Saturday April 29<sup>th</sup>, 2017

### ANTIMICROBIAL RESISTANCE - FROM AWARENESS TO ACTION

- ▶ "Veterinary Services including veterinarians and veterinary paraprofessionals have a key part to play in the fight against antimicrobial resistance, through their role in regulating and supervising the use of antimicrobials, offering professional advice to farmers and animal owners and collaborating with the human health sector.
- ▶ To continue to progress in **disease control management and in improving animal welfare**, veterinarians need to encourage and achieve a sustainable **change in behavior** towards a **responsible and prudent antimicrobial use**.
- ▶ **It is time to turn the words into action.** Through this year's WVD theme, the OIE and the WVA seek to encourage all the initiatives and events led by veterinarians, in collaboration with other sectors, to fight antimicrobial resistance and raise awareness on this essential issue in their countries."



# 15 One Health Case Studies...



46

The Association of American Veterinary Medical Colleges (AAVMC) + The Association for Prevention Teaching and Research (APTR) + Healthy People Curriculum Task Force (HPCTF) through the **One Health Inter-professional Education Initiative** developed **15 case studies** for integration into degree programs of health profession curriculums.

- A Veteran and His Dog – Carbon monoxide poisoning.
- *Bordetella* Infections in Cystic Fibrosis Patients.
- *Staphylococcus pseudintermedius*: Look What the Dog Dragged In?
- Care of Immunocompromised Individuals: The Role of Companion Animals in Mental Health.
- Lead Poisoning.
- Pet Ownership. A variety of examples of benefits and risks.
- Q Fever (*Coxiella burnetii*).
- *Brucella suis*: A Re-emerging Pathogen at the Human, Livestock and Wildlife Interface.
- Of Dogs and Men: Methicillin-resistant *Staphylococcus aureus* (MRSA).
- Human-Animal Interaction. One Health Educational Framework.
- Chagas Disease (*Trypanosoma cruzi*): Connections between Humans, Animals and the Ecosystem.
- More Than Just Companions: Role of Animal Assisted Therapies in Prevention, Health, & Wellness.
- Animals, Humans, and the Environment in the Epidemiology of Chikungunya Virus.
- When Nature Strikes! An Unusual Infection (*Baylisascaris procyonis*) a Child from New Orleans.
- Pathomechanics of Degenerative Joint Disease: A One Health Comparative Case Study Approach.

<http://www.aavmc.org/One-Health/Case-Studies.aspx>

# Benefits of Human – Animal Interactions

47



All professions are needed to make One Health the default way of doing business at all levels of research, clinical practice, governments and policy.

- Agriculturalists
- Animal Health Practitioners
- Anthropologists
- Climatologists
- Ecologists
- Economists
- Engineers
- Entomologists
- Forestry Specialists
- Geologists
- Human Health Practitioners
- Horticulturists
- Marine Biologists
- Plant Pathologists
- Political Scientists
- Social Scientists
- Wildlife Specialists
- ... and more!



**Cheryl Stroud, Bruce Kaplan, Jenae Logan & Gregory Gray: One Health training, research, and outreach in North America. *Infection Ecology & Epidemiology* 2016, 6: 33680.**

- \* Food Security
- \* Food Safety
- \* Nutrition

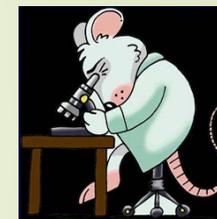


- \* Emerging Infectious Diseases
- \* Antibiotic Resistance

Emergency Response

Bio/Agro-Terrorism

# One Health Opportunities



Biomedical Research

- \* Climate change
- \* Planetary Health
- \* Environmental Health



Disability

- \* Obesity
- \* Physical Activity



Mental Health



Occupational Health



Injuries



## Engaging in a Multidisciplinary One Health approach...

- ▶ **You** can be the agent of change.... first, seek to understand, then reach out to other disciplines to “bring the needed expertise to the table” in a collaborative effort to address the needs more efficiently, and often with an innovative approach not previously considered.
- ▶ Engage policy/law makers from your local community, state, and federal levels to embrace a One Health collaborative, multidisciplinary approach to issues of mutual concern. Tell the “story” and provide the examples.
- ▶ Work with granting agencies (and government) to develop cross disciplinary funding proposals that encourages collaboration and embraces innovative technologies.

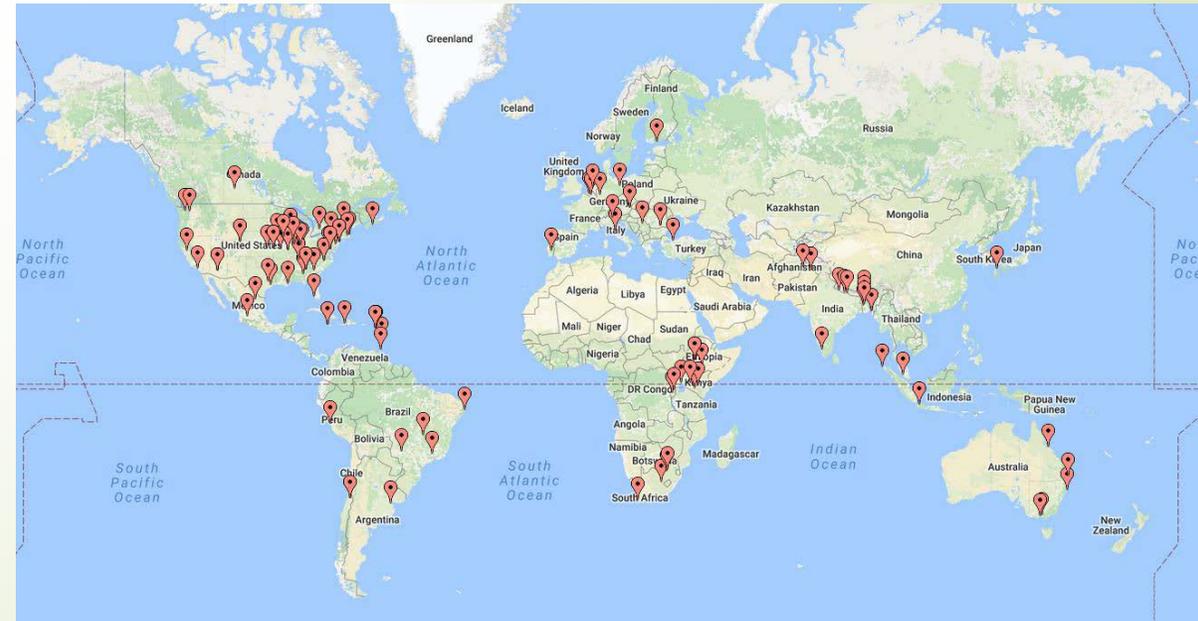
## Engaging in a Multidisciplinary One Health approach... cont'd

- ▶ Encourage: joint publications; joint grant applications.
- ▶ Collaborate on policy development based upon data analyses and the needs of a community, state or nation.
- ▶ Tell a story that your neighbors can relate to when explaining what One Health is all about. Small steps really do make a difference!! Make it personal and not overwhelming.
- ▶ Help facilitate introductions electronically, or by phone, or by in-person meetings... build relationships... engage in direct conversations... that lead to action items embracing a Multidisciplinary One Health approach!!!



## 165 One Health Day Events took place for the Inaugural One Health Day November 3<sup>rd</sup> 2016

Promoting efforts around the world to bring together all human, animal, plant and environmental health disciplines.



# Need additional information?

*Please feel free to contact me at:*

E-mail: [bdunham@gwu.edu](mailto:bdunham@gwu.edu)

Phone: 202-994-3781

Bernadette Dunham, D.V.M., Ph.D.  
Milken Institute School of Public Health  
The George Washington University  
950 New Hampshire Ave., N.W.  
Washington, D.C. 20052





**Thank you!**