One Health in Action: Interprofessional collaboration & Education to eliminate Neglected Tropical Diseases (NTDs)& Antimicrobial Resistance (AMR)

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https://gregorycolbert.com/GirlWithElephantPoster.php

Outline

1. Introduction to One Health (OH)

2. What is the relevance of the medicinal chemist to the OH agenda?

3. OH Education Topics: Inexorable Emerging Infectious Threats &

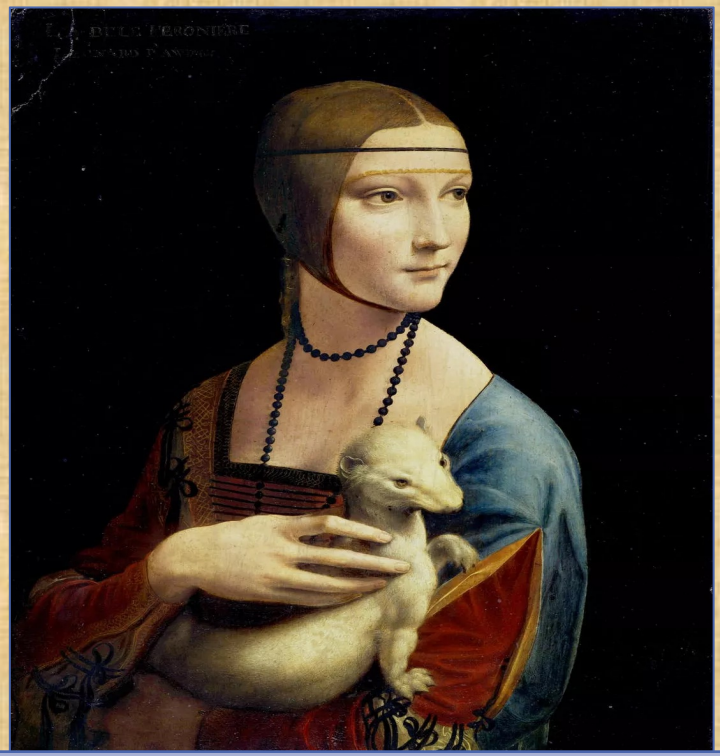
   - *EU Roadmap 2024-2026: OH Agenda for Infectious Disease Prevention*
   - *Economic impact of an OH approach*

4. EU Roadmap 2025-2032: OH agenda for Antimicrobial Resistance (AMR).

5. OH Education: A tool for Preparing Health professionals for future practice

6. Conclusion

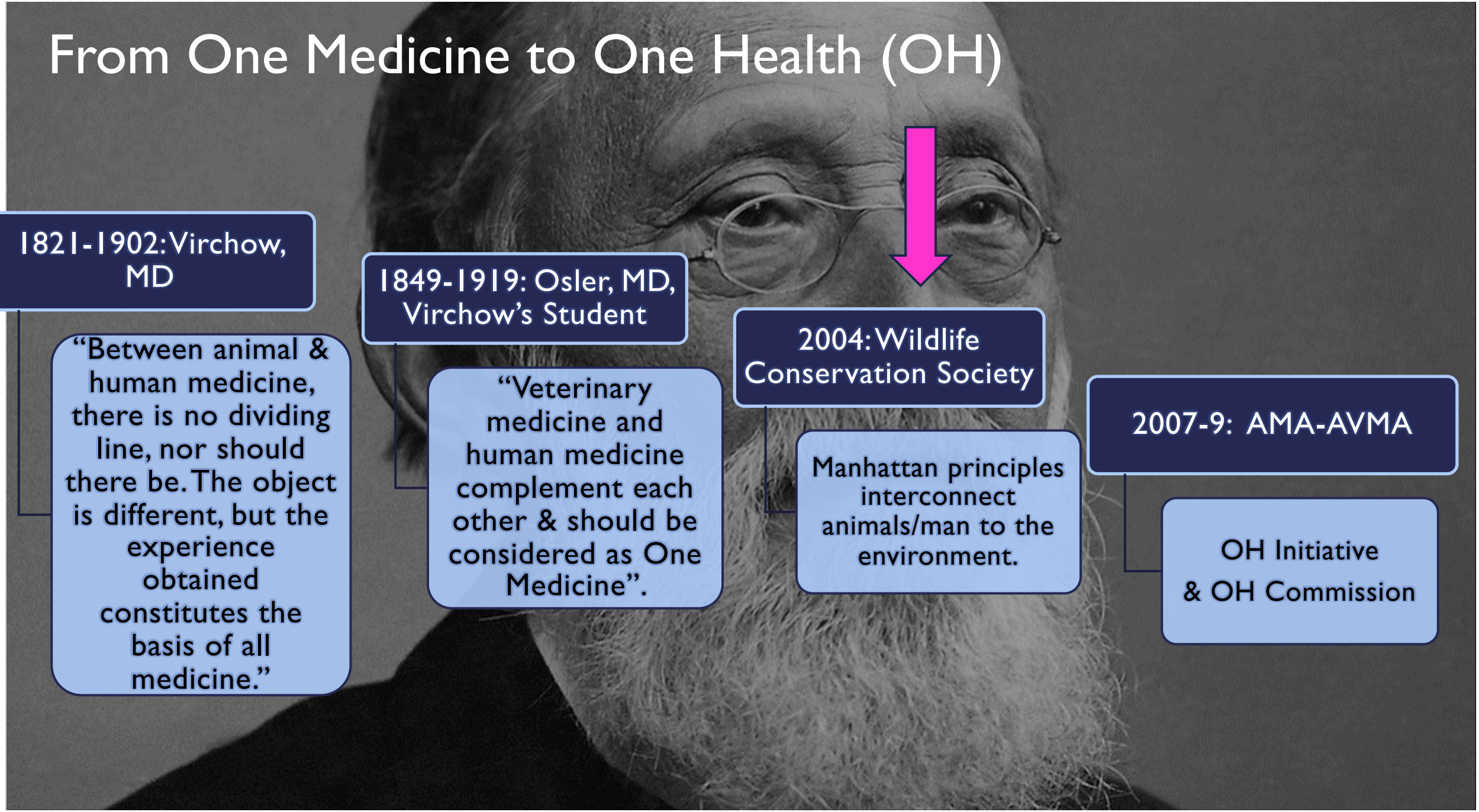
Introduction to One Health (OH)



460-367 BC: Hippocrates: If you want to learn about the health of a population, look at the air they breathe, the water they drink, and the places where they live"

1500 AD: Da Vinci stated "Animals are the image of the world. They reflect the Earth, just as we do."

From One Medicine to One Health (OH)



1821-1902: Virchow, MD

"Between animal & human medicine, there is no dividing line, nor should there be. The object is different, but the experience obtained constitutes the basis of all medicine."

1849-1919: Osler, MD, Virchow's Student

"Veterinary medicine and human medicine complement each other & should be considered as One Medicine".

2004: Wildlife Conservation Society

Manhattan principles interconnect animals/man to the environment.

2007-9: AMA-AVMA

OH Initiative & OH Commission

Urgency to promote OH

2019: COVID pandemic, human deaths, ~7M in 229 countries, also infecting many animal species leads to:

2021:

- *Quadripartite* designates a One Health High-Level Expert Panel (OHHLEP) to create a definition of OH, to implement their Action Plan & streamline cooperation among the G20 governments.

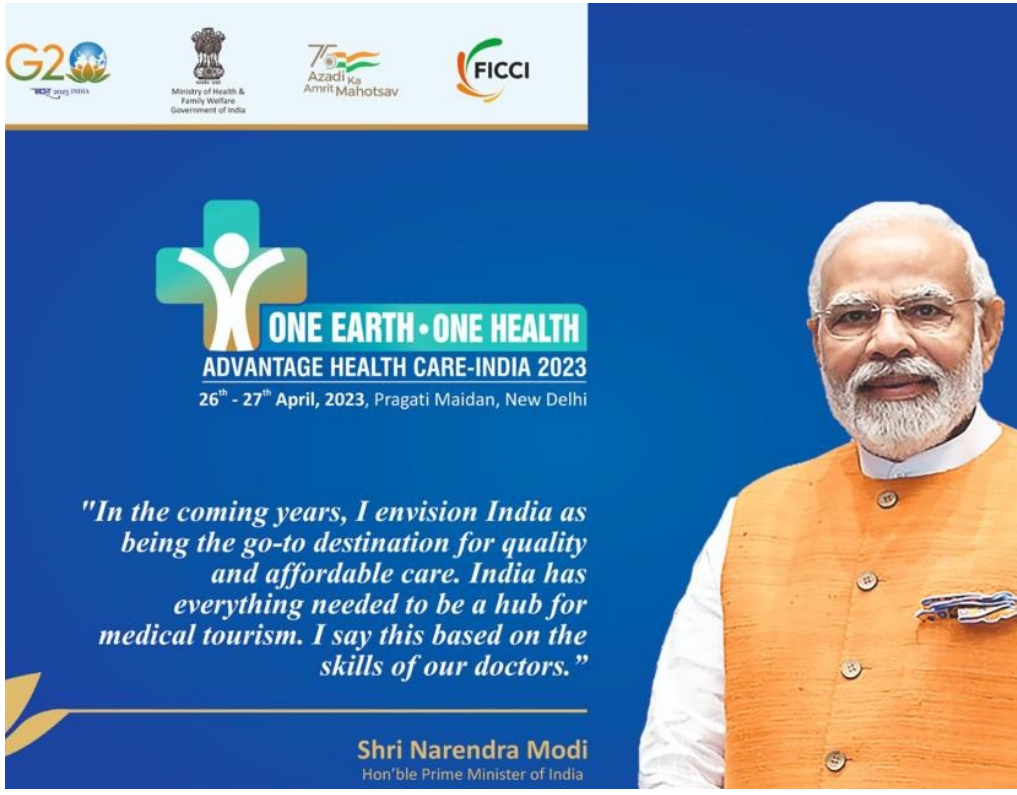
2022:World Bank:*"Putting Pandemics Behind Us: Investing in One Health to Reduce Risks of Emerging Infectious Diseases," a clarion call for its universal adoption."*

https://www.worldbank.org/en/news/feature/2022/10/24/one-health-approach-can-prevent-the-next-pand

- **Rome 2021**: *"We establish a G20 Joint Health Task Force aimed at enhancing global cooperation on issues relating to pandemic prevention, ..while adopting a One Health approach.*

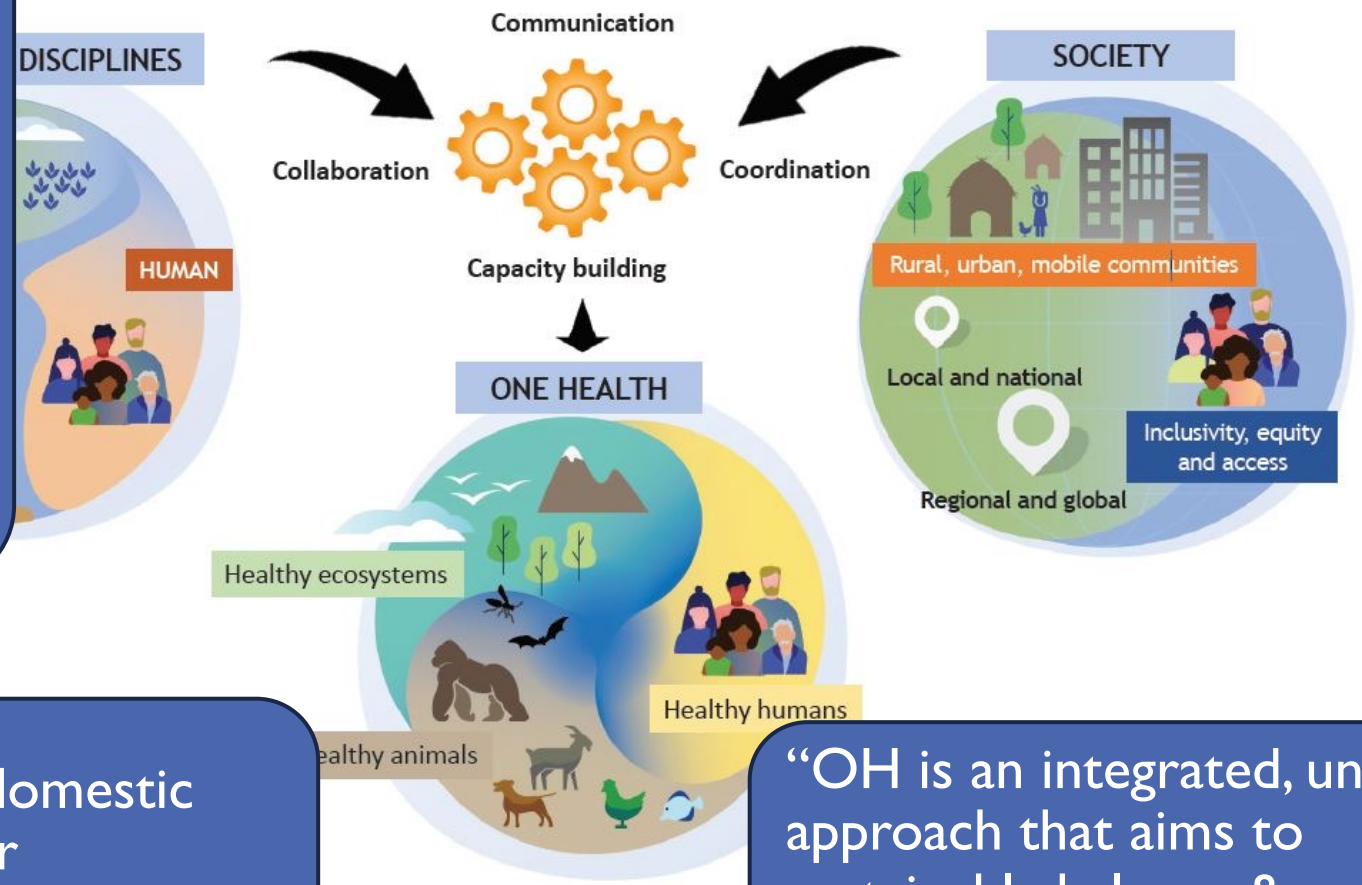
- *We commit to pursue a OH approach…..enhance global surveillance ..under the coordinating role of the WHO, FAO, OIE and UNEP, and address risks emerging from the human-animal-environment interface, particularly the emergence of zoonotic diseases, & global efforts to fight AMR"*

- ***India 2023: G20** reinforce commitment to OH*



Defining One Health(OH). OHHLEP, 2021
Ultimate goal: Collaboration, Communication, Coordination,Capacity build

"The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health & ecosystems, while addressing the collective need for clean water, energy & air, safe & nutritious food, taking action on climate change, & contributing to sustainable development."



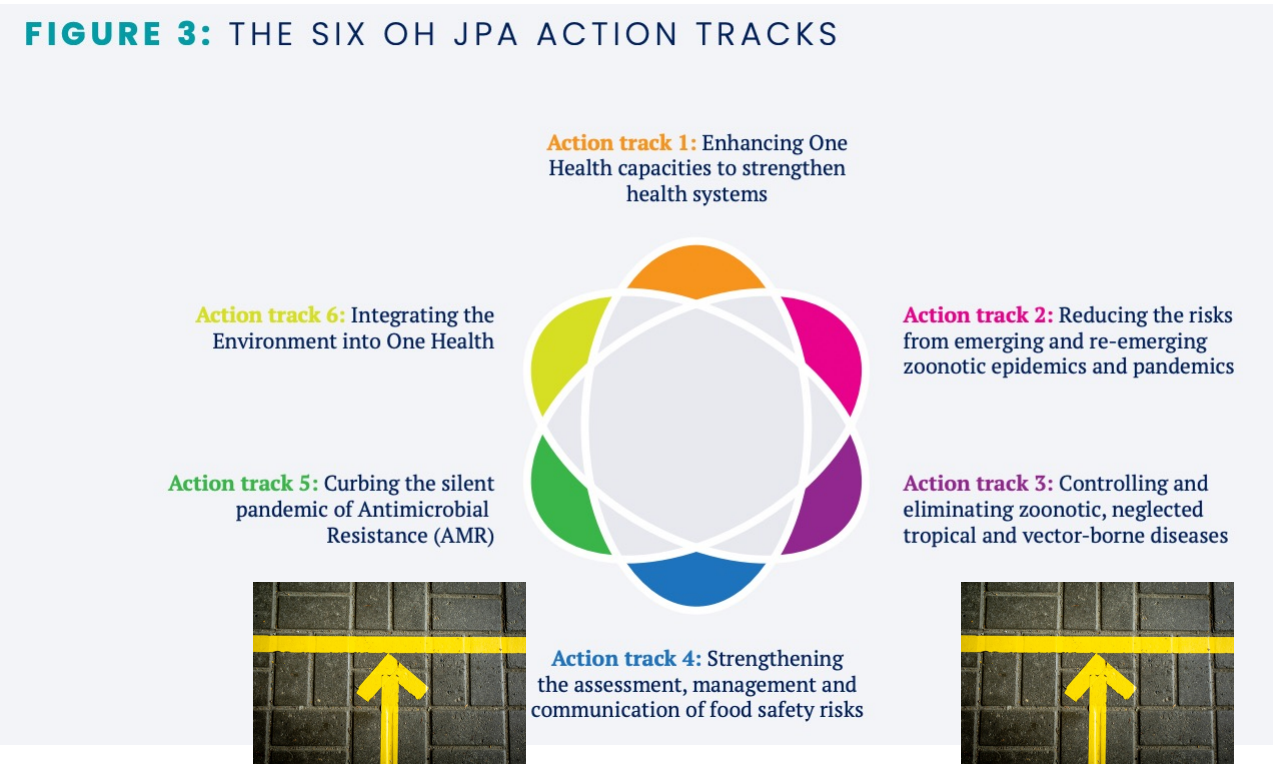
"It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent."

"OH is an integrated, unifying approach that aims to sustainably balance & optimize the health of people, animals & ecosystems."

2022:Quadripartite Joint Action Plan 2024

WHO Pandemic Agreement

FIGURE 3: THE SIX OH JPA ACTION TRACKS

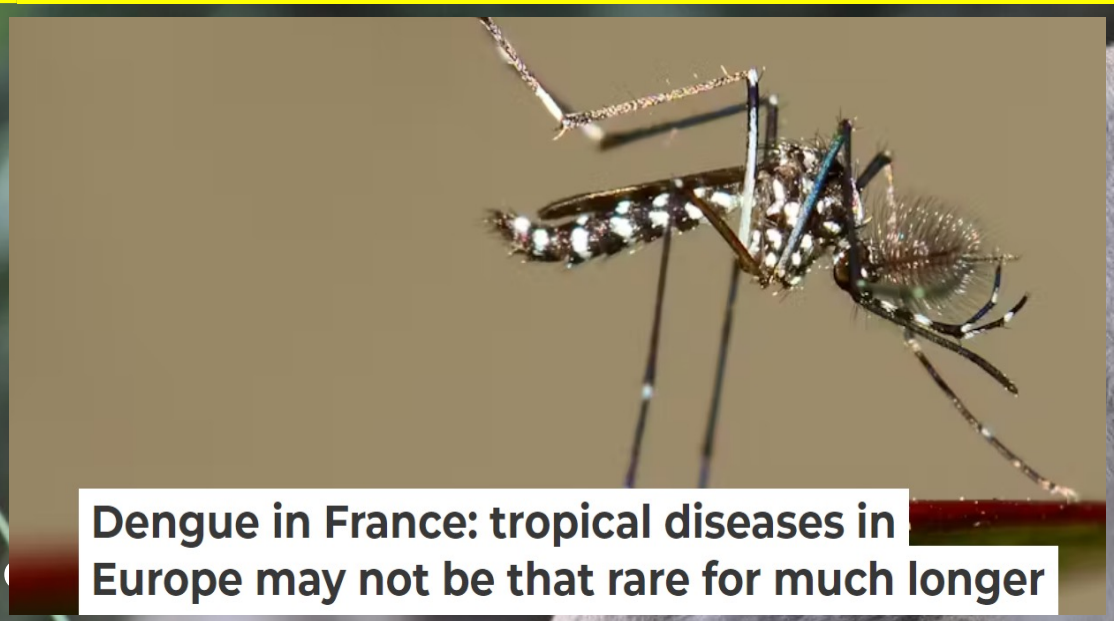


The Parties commit to promote a collaborative, OH approach in developing policies aimed at pandemic prevention to:

- Prevent/respond to zoonotic outbreaks
- Provide workforce training on OH approaches for public health, animal health & environmental sectors, to build capacities.

https://cdn.who.int/media/images/default-source/health-topics/one-health/the-six-oh-jpa-action-tracks.png?sfvrsn=1e89b39e_3

Why One Health? You Don't Want To Monkey Around With Monkey Malaria



Dengue in France: tropical diseases in Europe may not be that rare for much longer

Nature C

Nature, 2022

Zoonotic malaria requires new policy approaches to malaria elimination

Kimberly M. Fornace, Chris J. Drakeley, Kim A. Lindblade, Jenarun Jelip & Kamruddin Ahmed

Nature Communications **14**, Article number: 5750 (2023) | Cite this article

Increasing numbers of human zoonotic malaria cases are reported globally. Current malaria control measures cannot eliminate transmission from wildlife reservoirs, leaving many countries with no pathway to malaria elimination certification. New policies are needed to redefine elimination goals and certification.

NEWS | 11 February 2022 | Clarification 15 February 2022

Just 14 cases: Guinea worm disease nears eradication

A scourge that once infected millions of the world's poorest people is close to being wiped out in humans – but infections in animals complicates the picture.

H

ttps://www.npr.org/sections/goatsandsoda/2014/12/11/369666584/you-dont-want-to-monkey-around-with-monkey-malaria

OH & the SDG goals

What is the relevance of the medicinal chemist to the OH agenda?

- Part of a One Health team. Interprofessional Education & collaboration: veterinarians, physicians, public health, ecologists, chemists, pharmacists..
- Climate change & Emerging Zoonoses
- Environmental impact: veterinary drugs

One Health Education Topics:

Inexorable Emerging Infectious Threats

Focus on a NTD

European Commission, May 2024-2026: One Health Roadmap for Preventing Infectious Diseases

- Coordinate, Communicate, Collaborate, Capacity-Build (Workforce training)
- Physicians, veterinarians, environmentalists, public health, policy-makers….

Geared at designing informed policies to minimize emerging threats:

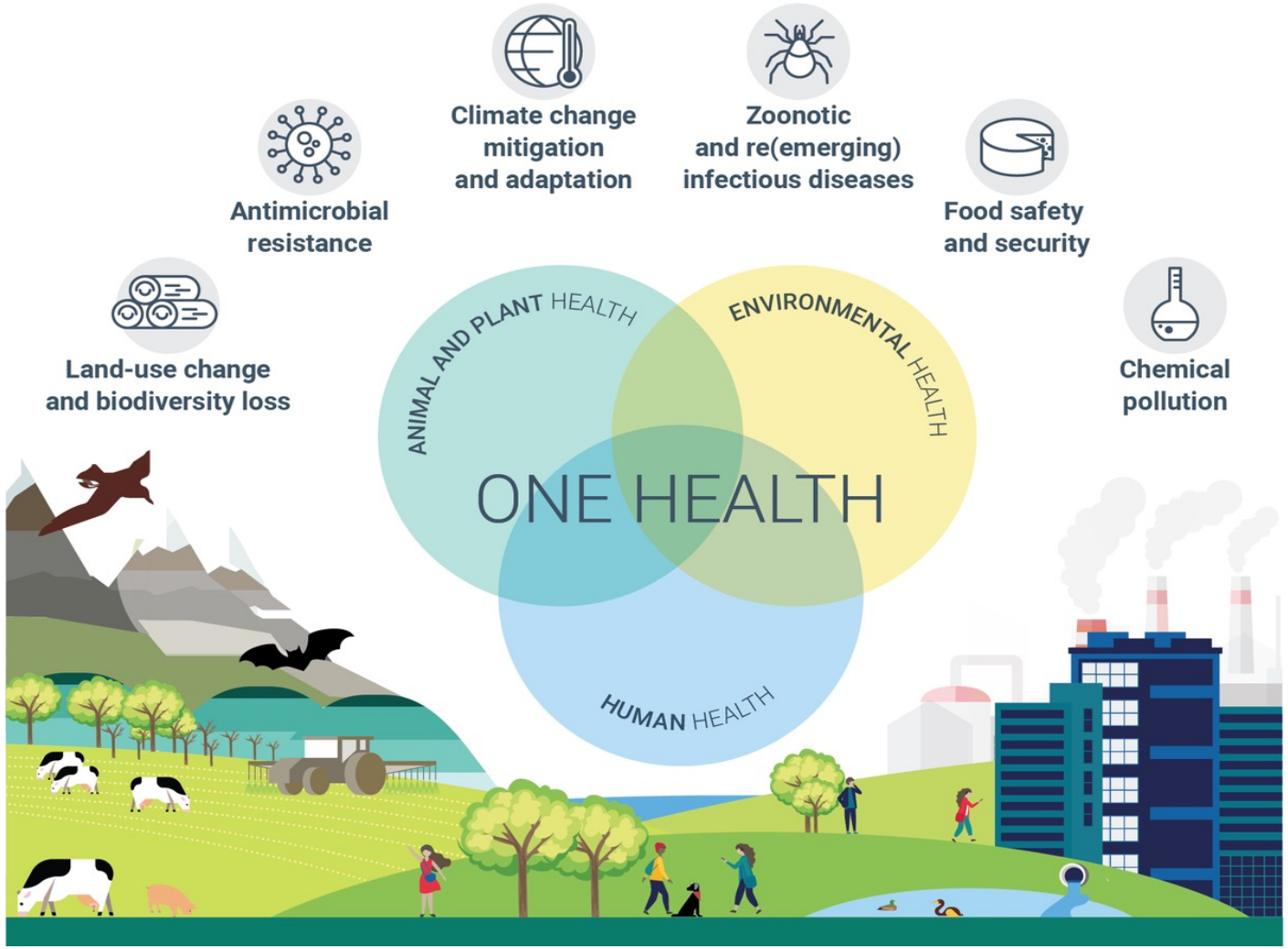
- Climate change,
- AMR,
- Zoonoses,
- Chemical pollutants.

Joint surveillance in animals, humans, environment on disease.

Interdisciplinary research to address knowledge gaps

One Health Education: Targeted Global health threats.

2019: AMR infections @4.95 mill. deaths globally. By 2050, AMR-infections>10 million deaths/year



Major areas targeted by the One Health approach. Source: the EU One Health Task Force

A OH issue: Climate Change & Zoonoses Transmission

How Climate Change Creates More Pathways for Zoonotic Disease Transmission

Higher temperatures | Rainfall variability | Higher sea levels | Storms | Floods | Droughts | Wildfires | Heat waves

Direct contact between species increases

Example: During droughts, people and animals are likely to gather more frequently at the same sources of water as disease-carrying mosquitoes.

Geographical ranges of host animals and insects change

Example: Vampire bats native to Mexico and Central America could move to the southern United States as temperatures increase.

Disease hosts thrive in more favorable conditions

Example: Heavy rainfall can lead to increased vegetation, which allows host animals such as rats to reproduce more.

New diseases emerge

Example: Bacteria that have long been frozen in glaciers could resurface as the ice melts and infect wildlife.

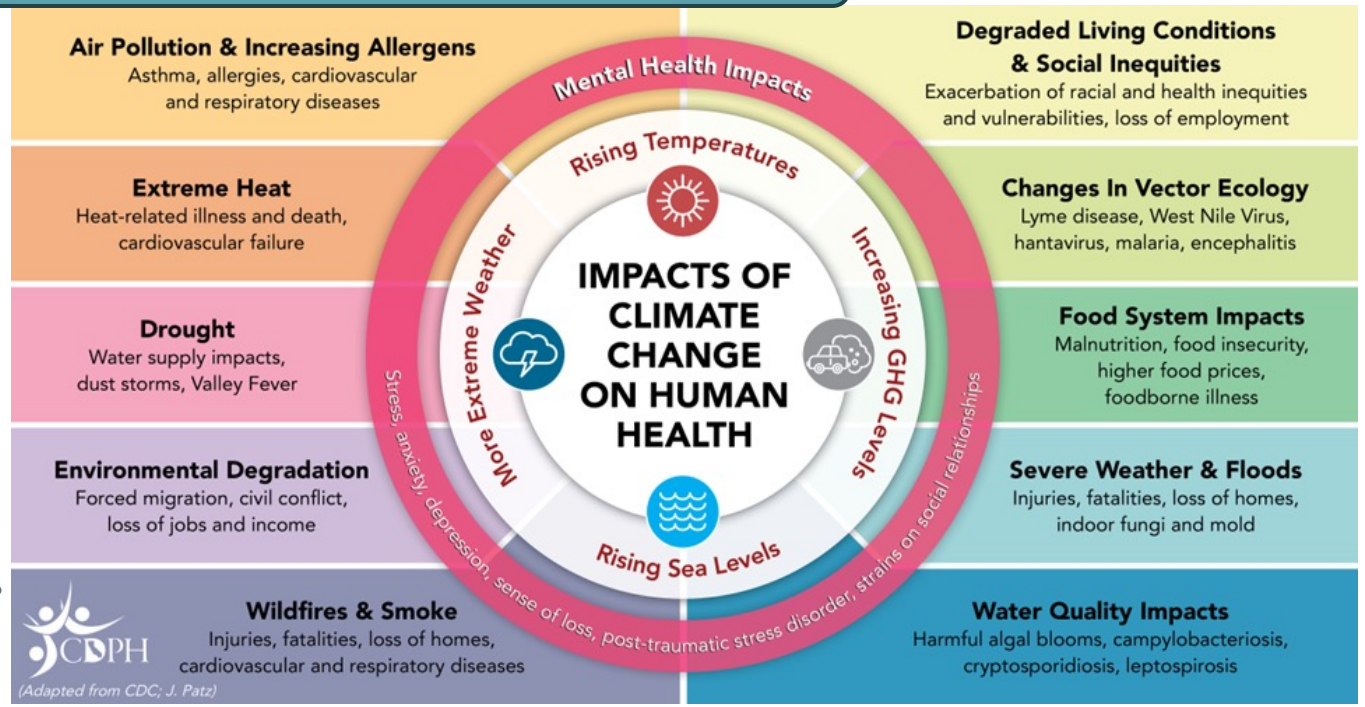
Human resistance to diseases weakens

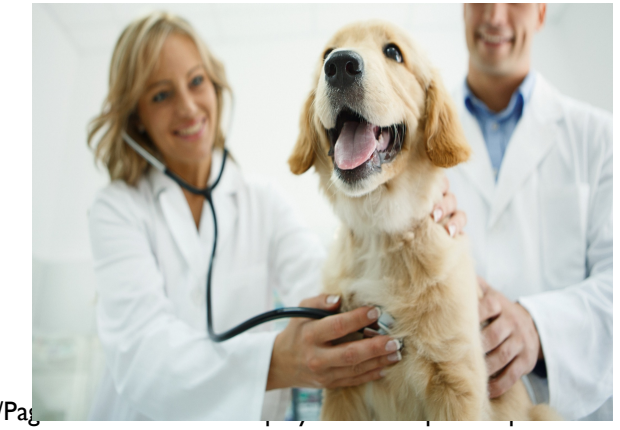
Example: Climate change effects such as extreme heat can exacerbate chronic illnesses, making it harder for people to fight off other diseases.

Source: CFR research.

COUNCIL on FOREIGN RELATIONS

Environmental, human & animal impacts





https://www.cfr.org/article/perilous-pathogens-how-climate-change-increasing-threat-disea rams/OHE/Pag

European definition of the Family physician (GP) June 2023, Brussels.

3 new curricula components for future GPs:

-OH

-Planetary health

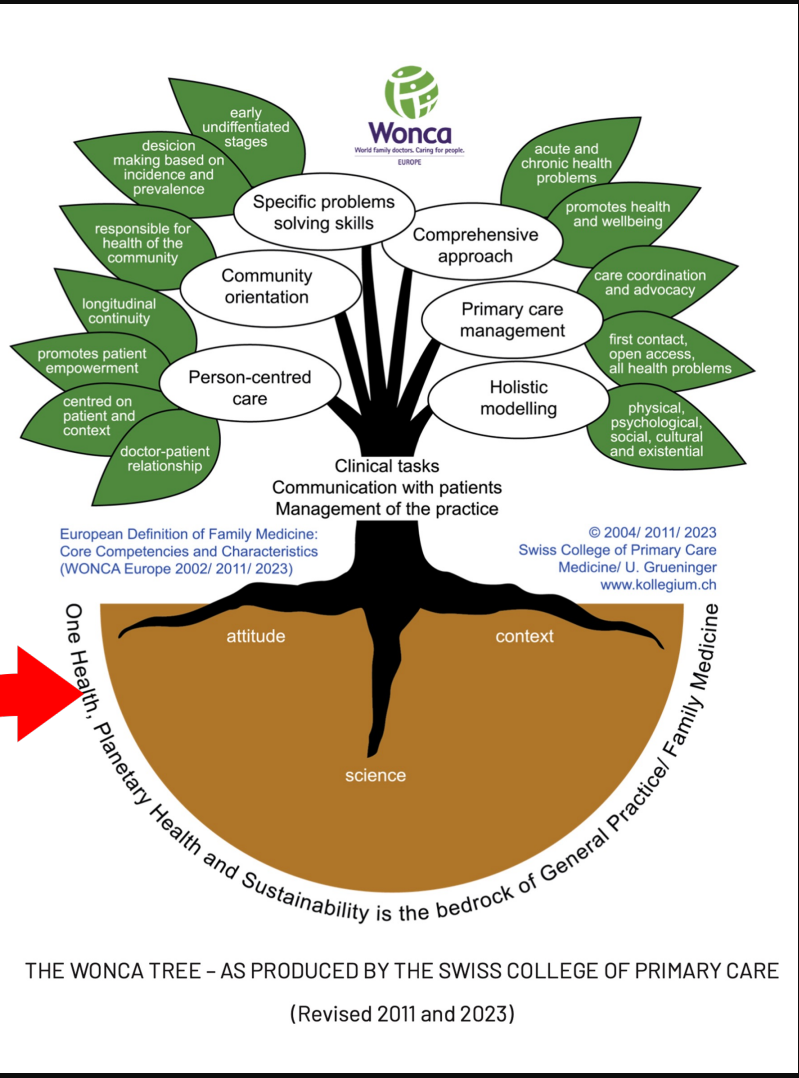
-SDGs

Why the change?

Climate crisis threat to health?

Human health depends on:

- Environmental health:Minimize health impacts
- Animals: Food safety / Zoonoses



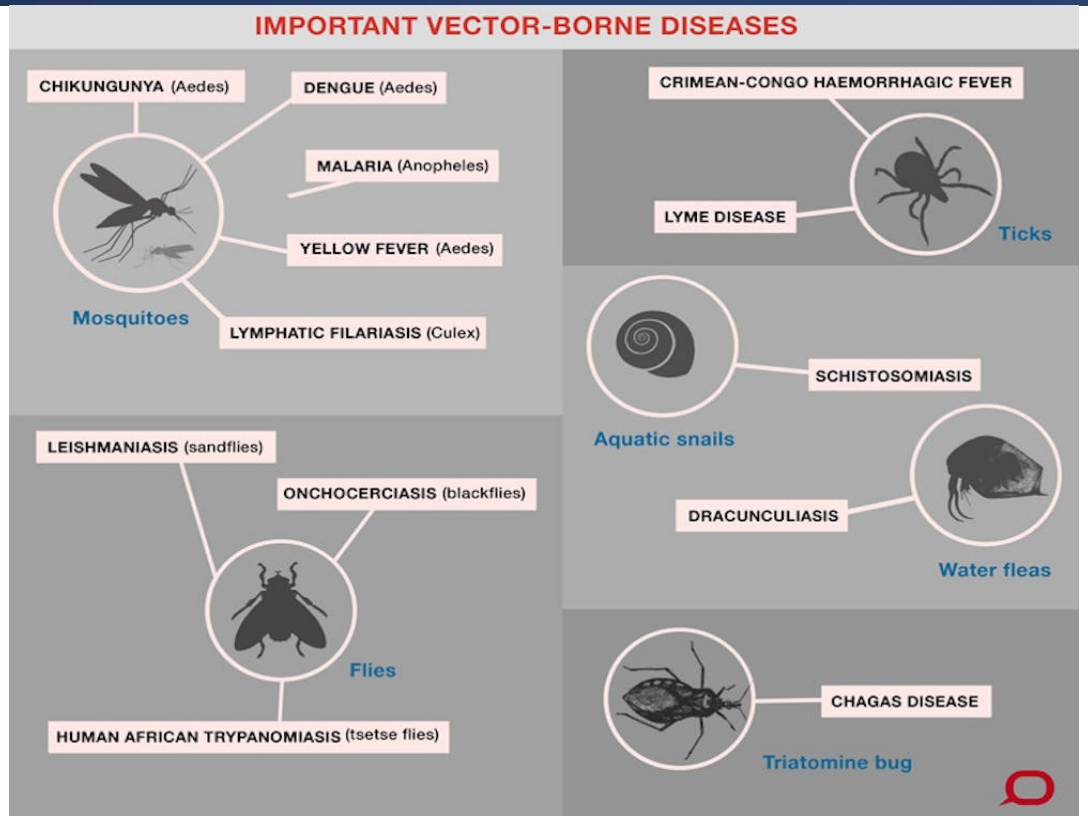
THE WONCA TREE – AS PRODUCED BY THE SWISS COLLEGE OF PRIMARY CARE

(Revised 2011 and 2023)

World Organization of National Colleges,Associations (WONCA) of Family Physicians

https://www.ipcrg.org/resources/search-resources/the-european-definition-of-general-practicefamily-medicine-wonca-europe

A OH issue: NTDs at the Human-Animal-Environmental Interface

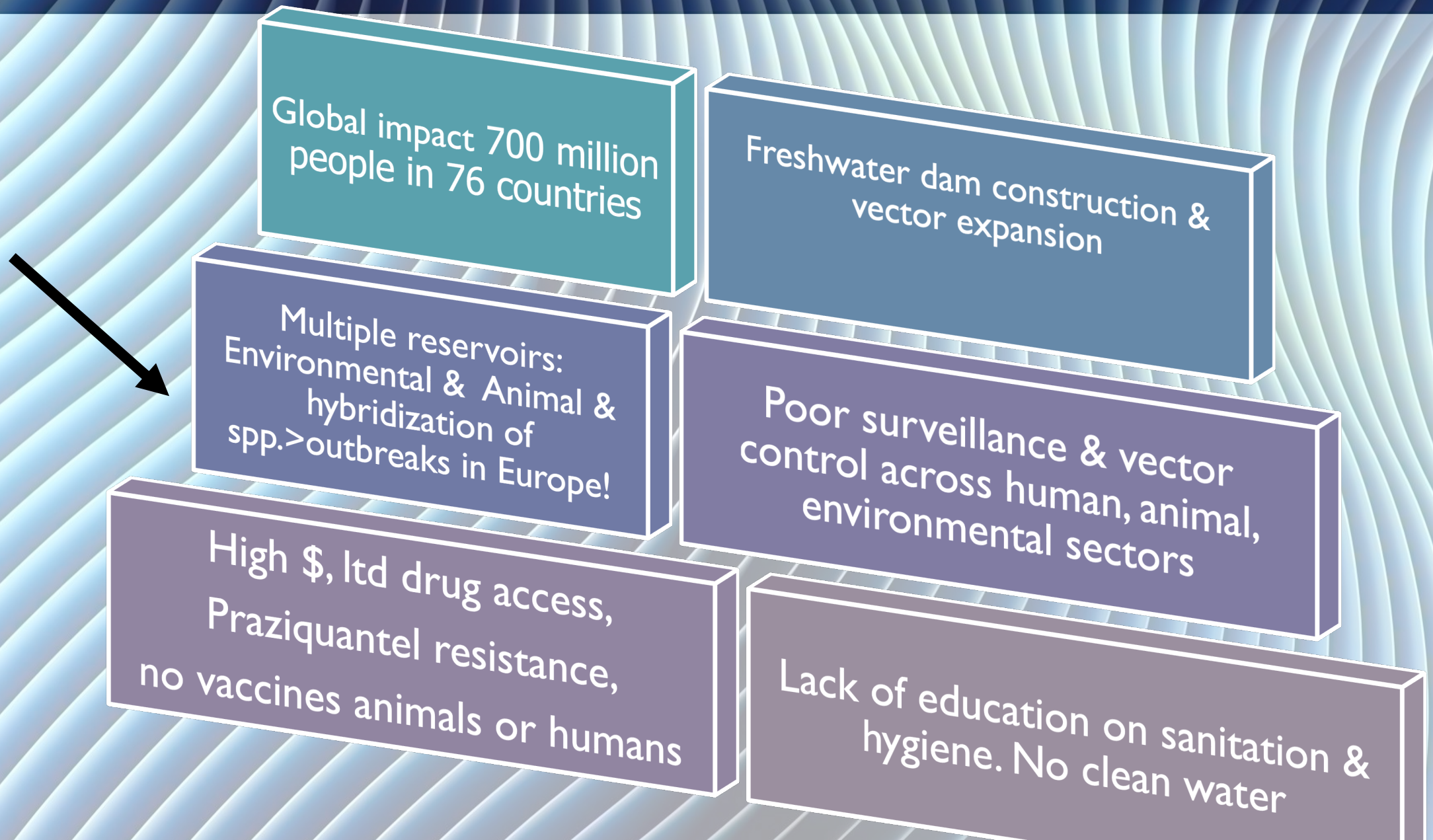


Category	Disease
Protozoan infections	1. Chagas disease 2. Human African trypanosomiasis 3. Leishmaniasis
Helminth infections	4. *Taenia solium* (neuro) cysticercosis/ Taeniosis 5. Dracunculiasis 6. Echinococcus 7. Foodborne trematodiases 8. Lymphatic filariasis 9. Onchocerciasis 10. Schistosomiasis 11. Soil-transmitted helminthiases (ascariasis, Hookworm diseases, trichuriasis, strongyloidiasis)
Bacterial infections	12. Buruli ulcer 13. Leprosy 14. Trachoma 15. Yaws
Viral infections	16. Dengue and chikungunya fevers 17. Rabies
Fungal Infections	18. Mycetoma, chromoblastomycosis, deep mycosis
Ectoparasitic infections	19. Scabies, Myiasis
Venom	20. Snakebite envenoming

*Source. World Health Organisation. Neglected Tropical Diseases 2017 https://www.who.int/neglected_diseases/diseases/en/.

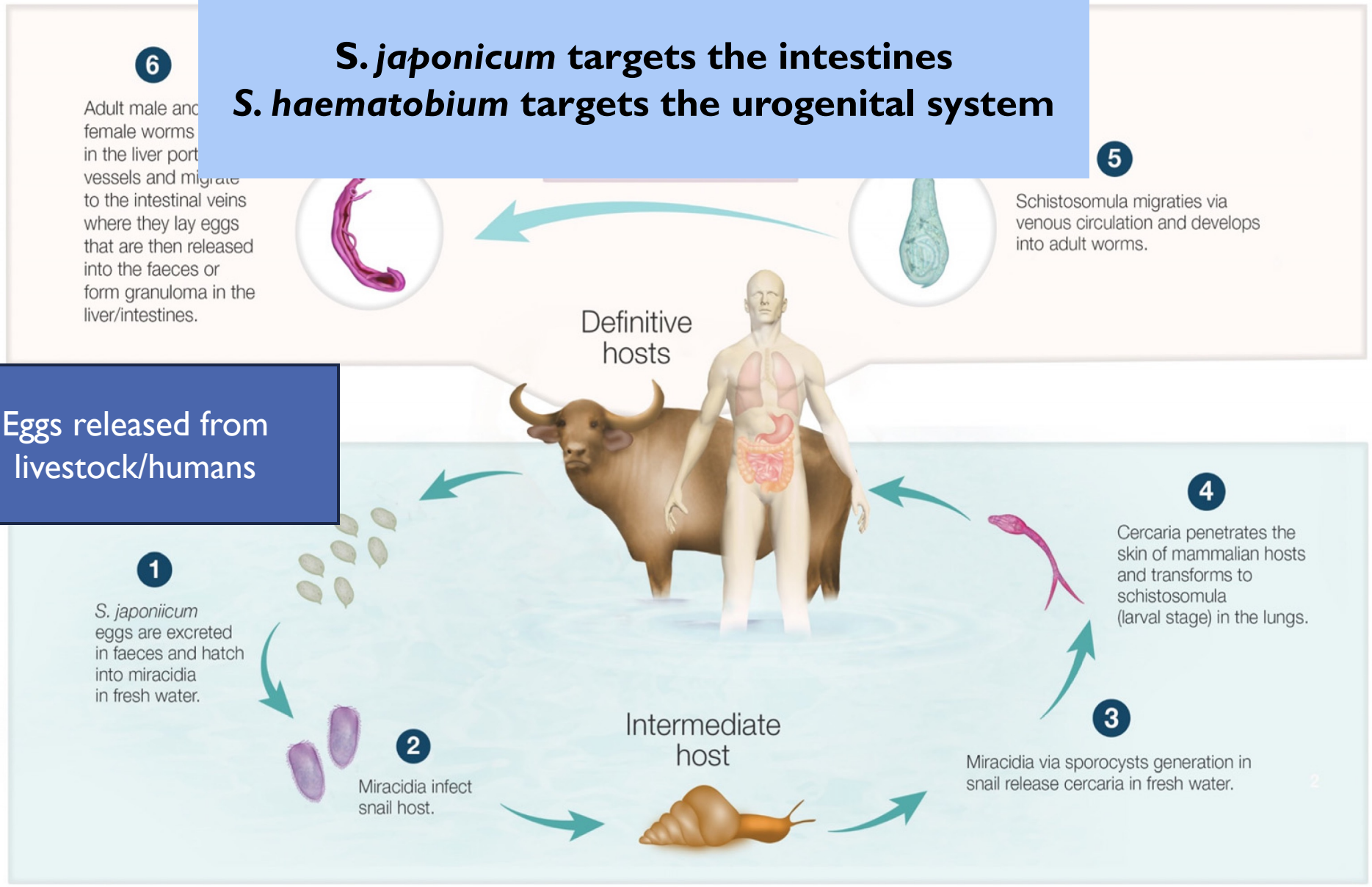
Source: The conversation.com

NTDs: Public Health Control Challenges: Focus on Schistosomiasis



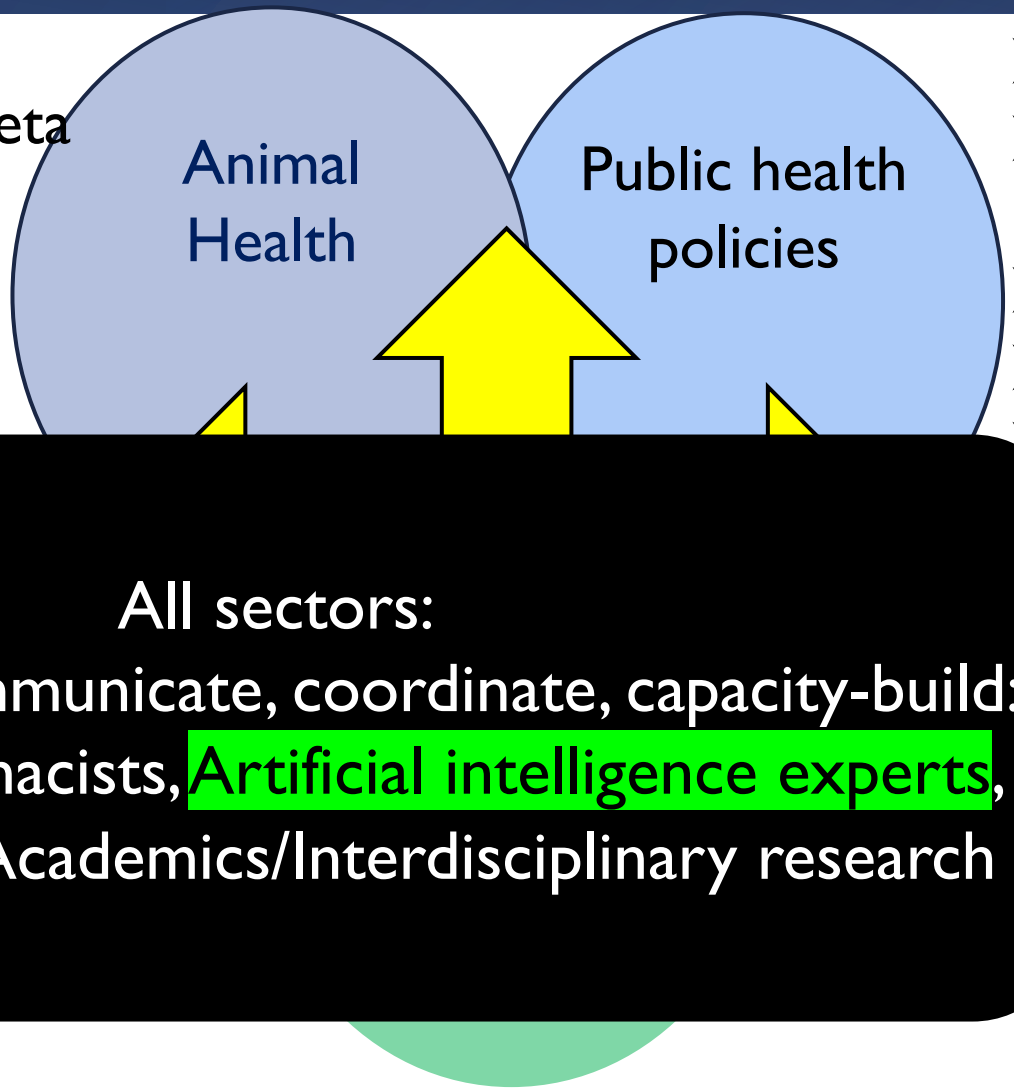
Life cycle of zoonotic spp. *Schistosoma japonicum*

S. *japonicum* targets the intestines
S. *haematobium* targets the urogenital system



OH: A Systems Thinking Approach, points of multisectoral collaboration

- Praziquantel
- Prevent livestock excreta in freshwater sources
- Share AMR data
- Research hybrids
- New Drug/vaccine



- Praziquantel
- Prevent waste entering water sources.
- WASH
- Community education
- Research Schisto/hybrids
- Drug /vaccine development
- AMR monitoring

egetation to limit snail habitation
al control with natural predators
icides

All sectors:
Collaborate, communicate, coordinate, capacity-build:
Chemists, Pharmacists, Artificial intelligence experts,
Parasitologists, Academics/Interdisciplinary research

Economics: Benefits of integrated West Nile virus (WNV) surveillance in Italy 2009-2015. Paternoster et al., 2017

Animal, Vector, Public Health (Emilia-Romagna)

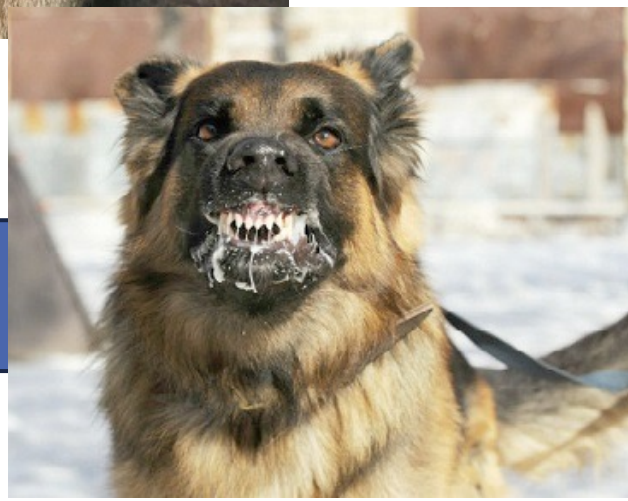
- Information shared to guide PH interventions
- Human donor screening *ONLY* if cases found in birds, horses, mosquitoes & PRIOR to a human case being detected.

Savings €1.21 million in avoided tests on blood units by detecting cases in non-human spp. prior to the occurrence of a human case.

Uni-sectoral (other provinces)

- Human case detected then donor blood screening done on ALL donors & *again a year later*

Rabies NTD: Economics of A OH approach



PEP cost of 1 person =Vaccination of 50 dogs

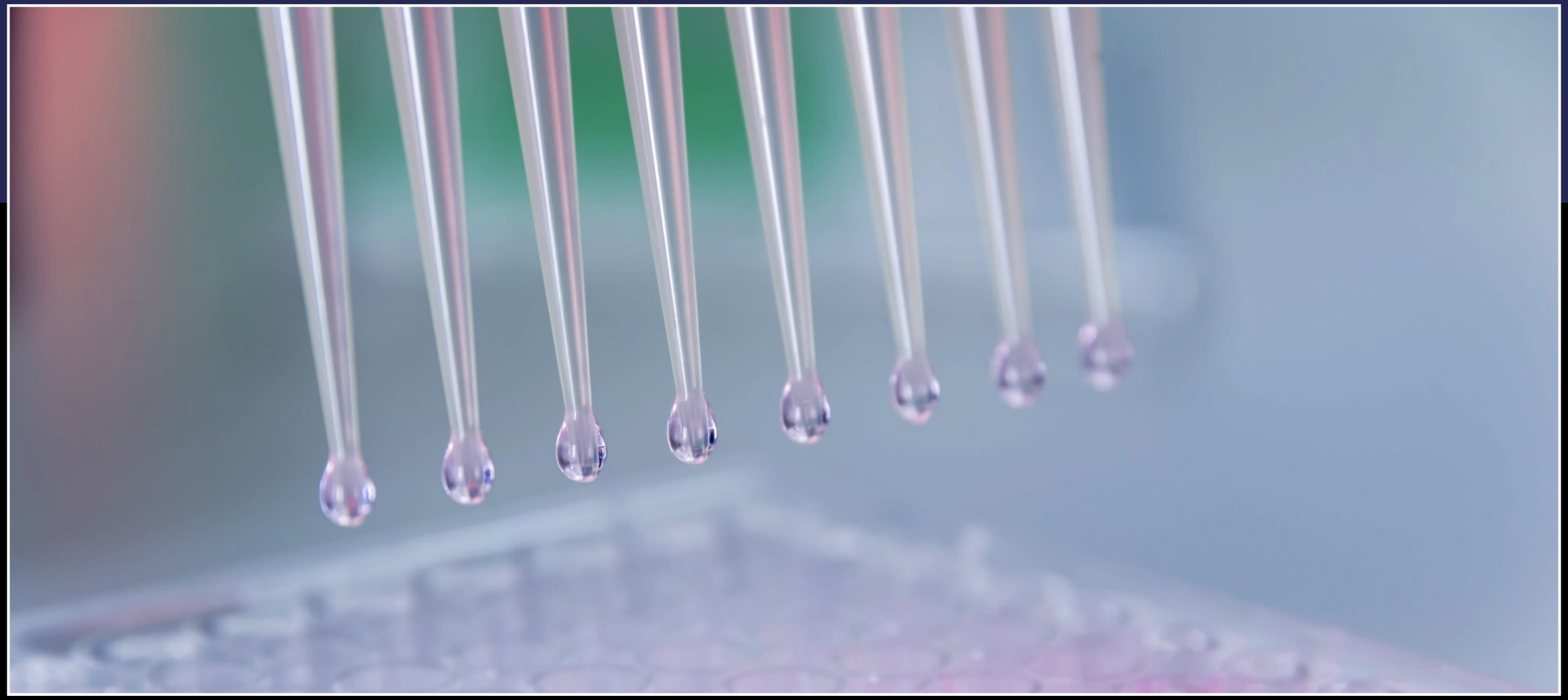
108 USD/person

2.18 USD/dog

Save costs on Post- Exposure prophylaxis (PEP) for persons bitten by dogs

Save hospitalization cost; workforce impact

https://www.graphic.com.gh/news/health/spread-of-rabies-unvaccinated-dogs-cats-deadly.html
https://health.hawaii.gov/docd/disease_listing/rabies/
https://patch.com/new-jersey/manalapan/rabid-bat-found-in-manalapan



OH Capacity building through Workforce Education: Antimicrobial Resistance

European partnership on AMR: One Health Roadmap of Actions: 2025-2032

- Coordinate, Communicate, Collaborate, Capacity-build
- Physicians, EU agencies, veterinarians,chemists, public health…

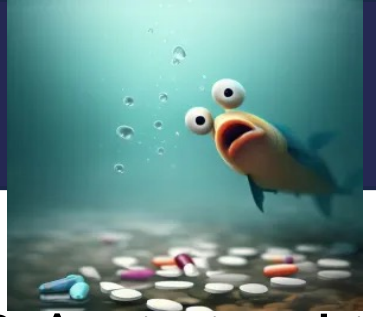
3 focus areas

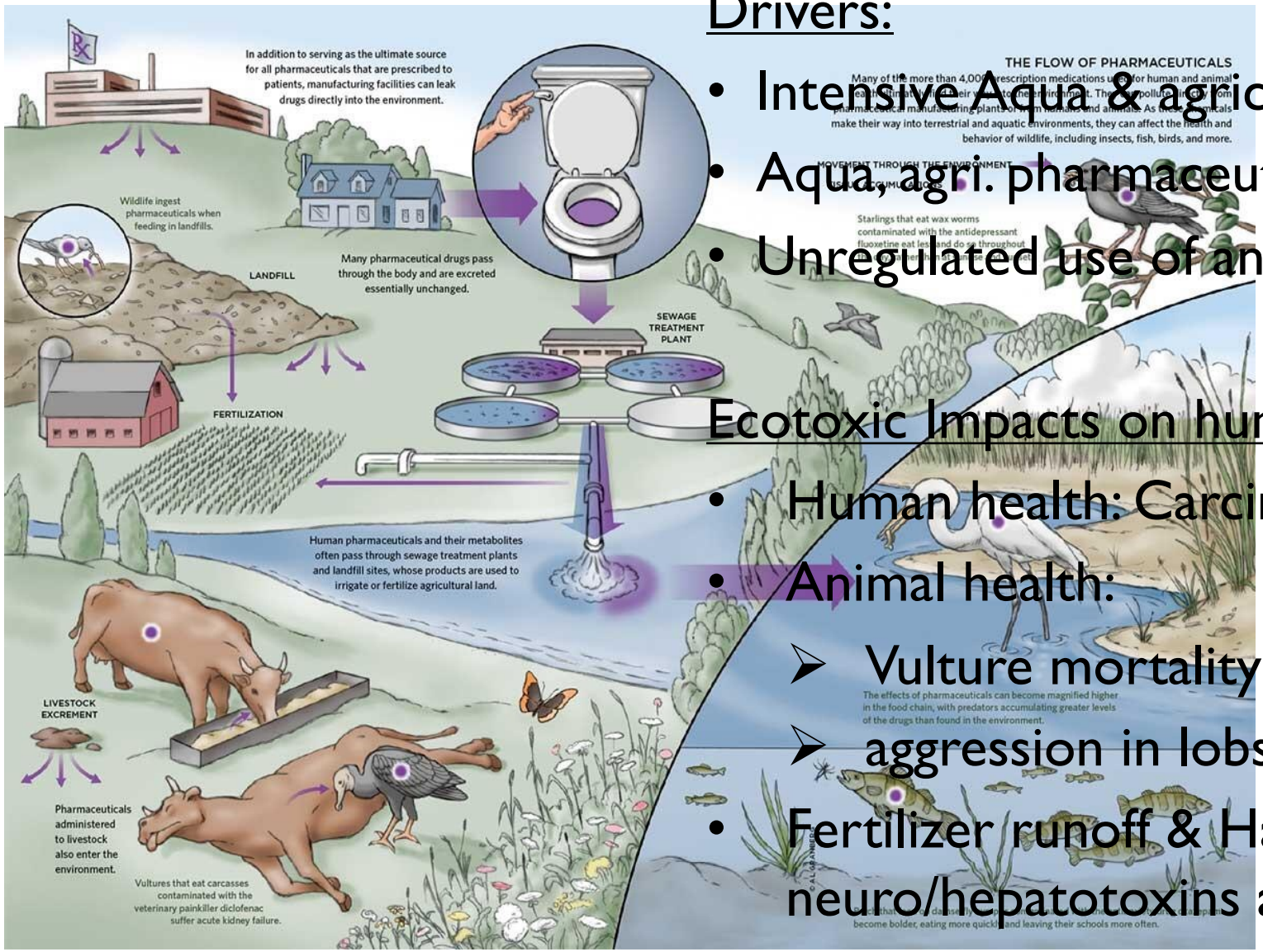
- Prevent emergence & spread of AMR
- Promote Antimicrobial stewardship through Disease prevention
- Develop cost-effective eco-friendly anti-fungals,..parasitics, ..viral, ..biotics

Tools

- Workforce training to build capacity
- Interdisciplinary research

Pharmaceutical Residues in the Environment





<u>Drivers:</u>

- Intensive Aqua & agriculture & Antimicrobial demands
- Aqua, agri. pharmaceutical & healthcare untreated waste
- Unregulated use of antimicrobials

<u>Ecotoxic Impacts on human, animal, ecosystem health:</u>

- Human health: Carcinogenic, neurotoxic, reproductive
- Animal health:
  - Vulture mortality in India(diclofenac)
  - aggression in lobsters(anti-depressants)
- Fertilizer runoff & Harmful Algal Blooms release neuro/hepatotoxins affecting human and animals

https://www.usgs.gov/special-topics/water-science-school/science/pharmaceuticals-water

https://ohbp.org/2023/05/05/pharmaceutical-pollution-and-the-blue-healthcare-revolution-health-europa-article/

OH approach: Lessons for Government & Industry

- Legislation to:
  - regulate pharmaceutical waste & strengthen treatment of waste-water to kill multi-AMR organisms in agri. & aquaculture, human waste in the environment
  - enforce judicious prescribing/stewardship of Veterinary/human drugs
- Joint AMR surveillance & share data across H-A-E systems
- Industry to engage with medicinal chemists:
  - $ incentives to design environmentally biodegradable drugs: animals/humans.
  - Initiatives to obtain licensing of cheaper, effective generic drugs for patients
  - Research to develop new drugs for co-infections & hybrid *spp*.!

Educate on the 4 C's of OH- towards Interprofessional Collaboration: Farmers, MDs, pharmacists, ecologists, veterinarians, physicians, chemists…..

Good diagnostics & tailored eco-directed prescribing to avoid AMR

Proper drug disposal.

Focus on prevention through Water, Hygiene, Sanitation (WASH)

Vaccines for humans & animals

- Leishmaniasis in dogs, none for humans
- Educate against vaccine hesitancy

One Health Education:
A tool for preparing Health professionals for future practice

https://iwbond.org/2020/03/14/zoonotic-diseases-of-mass-destruction/

Interprofessional Education (IPE): Paradigm shift to tackle global health

Current & emerging threats

Climatic change:

- Vector-borne, Zoonoses & Pandemics
- Food scarcity: Life below and above land
- Extreme heat, air pollution & Water quality
- Natural Disasters
- Loss of biodiversity

AMR

Translational research: cancer, chronic disease

Mental health-Human –pet bond, green spaces.

Stakeholders

- Universities & Interprofessional Education
- Pharmacists
- Medicinal chemists
- Educators: virologists, parasitologists
- Economists
- Public health
- Physicians
- Veterinarians
- Environmental health
- Government policy-makers
- Lawyers
- Social workers
- Mental health professionals

IPE Working Group

- How do we train future graduates acı the health professions to collaborate?
- Development of OH-related competencies using the platform of IF
- "IPE occurs when students from two more professions learn about, from, a with each other to enable effective collaboration and improve health outcomes." (WHO). (2010).

TABLE A6. IPEC CORE COMPETENCIES COMPARISON: VALUES AND ETHICS

JS

IPEC Core Competencies Comparison: 2016 and 2023

VALUES AND ETHICS

Original Code or Information	**Version 2** (2016)	**Version 3** (2023)
Core Competency Statement	Work with individuals of other professions to maintain a climate of mutual respect and shared values.	Work with **team** members to maintain a climate of shared values, ethical conduct, and mutual respect.
VE1.	Place interests of patients and populations at center of interprofessional health care delivery and population health programs and policies, with the goal of promoting health and health equity across the life span.	VE1. Promote the values and interests of **persons** and **populations** in health care delivery, One Health, and population health initiatives.

- **Communication**
  Communicate in a responsive, responsible, respectful, and compassionate manner with **team** members.
- **Teams and Teamwork**
  Apply values and principles of the science of teamwork to adapt one's own role in a variety of **team** settings.

https://www.ipecollaborative.org/about-us

National Institute of Antimicrobial Resistance Research and Education (NIAMRRE)

OH AMR: Learning Outcomes

International Implications

Novice: List what regulations and requirements are in place for antimicrobial use depending on the country across humans, animals, and plants and how that may affect trade for animals and plants.
Developing: Discuss the impacts of different regulations in different countries on the use of antimicrobials in humans, animals, and plants.
Advanced: Recommend clinical practices, educational programs, and surveillance policies for different countries based on their regulations to identify antimicrobial resistance concerns.

>>> Antimicrobial Stewardship

Definition and Society

Novice: Define antimicrobial stewardship, including the potential reduction or loss of effectiveness of antimicrobials.
Developing: Explain how antimicrobial stewardship can address increasing societal concern about antimicrobial resistance.
Advanced: Describe specific examples of resistance in microorganisms that are commonly found in humans, animals, and/or plants, and identify stewardship steps that can be implemented.

Use and Need

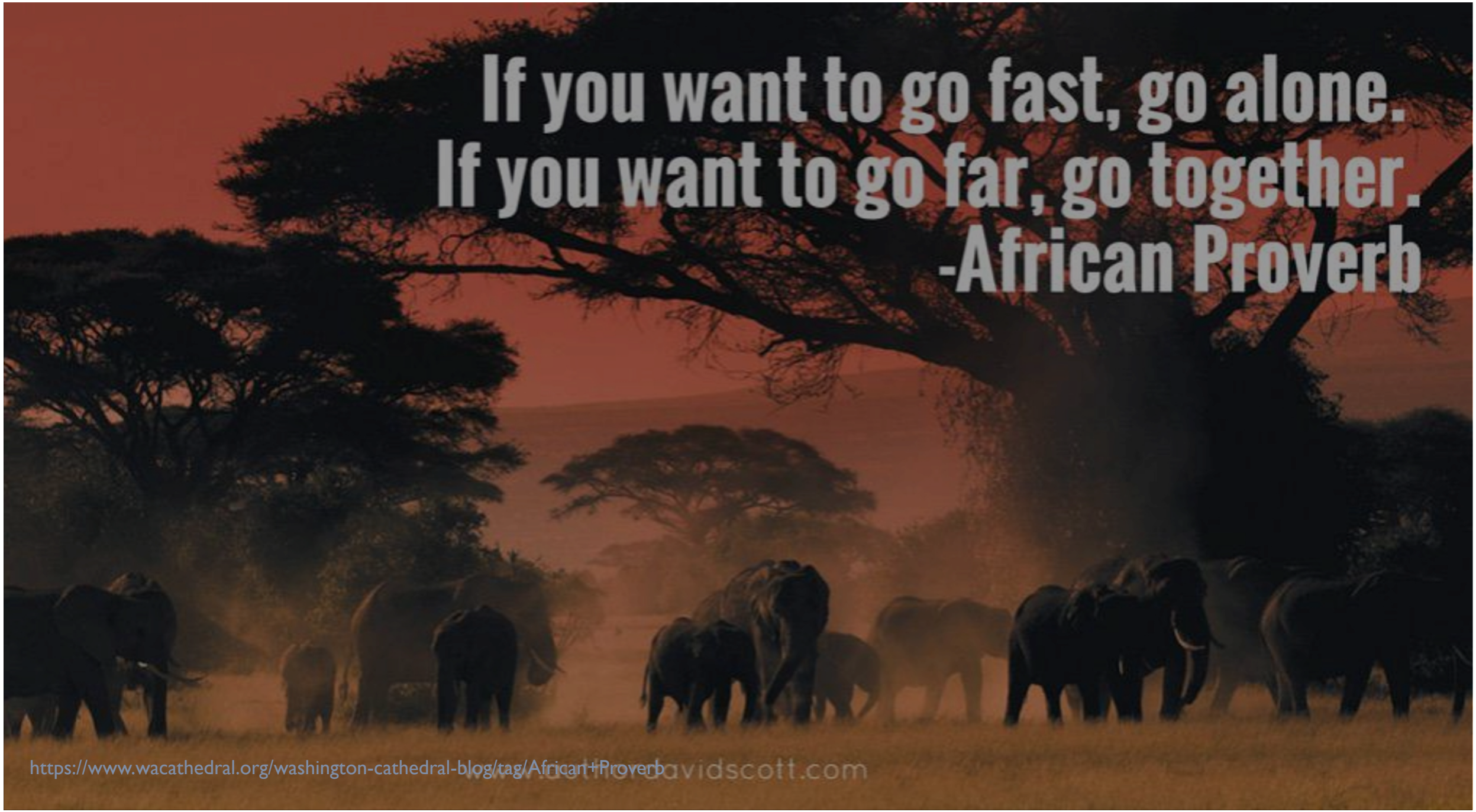
Novice: Identify common situations where antimicrobials are needed and not needed to address disease and that describe how risks can vary between species.
Developing: Describe common situations where antimicrobials are needed and not needed to address disease and that risks can vary between species.
Advanced: Explain the epidemiology and pathogenesis of common situations and diseases where antimicrobials are needed and not needed, and what factors of the human, animal, or plant being treated affect the need and benefit of antimicrobial use.

https://olafhajek.com/exhibitions

Conclusion: Future opportunities & needs

Call to Action: Health professionals at the frontier of One Health:

- Promote Interprofessional Education for OH Education
- Engage in Interprofessional Practice:4 C's to mitigate emerging threats
- Promote Antimicrobial stewardship to mitigate AMR
- Drive OH-framed Policy for optimal health of all spp. & our shared planet



https://www.wacathedral.org/washington-cathedral-blog/tag/African+Proverb

Appreciation:Prof. Costi,OH Initiative,Audience, Dr. Chen,Pandora Rose.

cost

EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by
the European Union

Pandora Rose, University of Florida

https://onehealthinitiative.com/


Bruce Kaplan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Questions

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