One World, One Medicine, One Health: a strategy behind the concept?

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infectious diseases in a changing world

**dynamics of emergence**

Emerging infections: *infections that have newly appeared in a population or have existed previously but are rapidly increasing in incidence or geographic range*  
(Morens M et al., *Nature*, 2004)

- 60% of human infectious diseases ... .... of animal origin.
- 75% of human emerging infections ... .... are zoonoses .  
  (Woolhouse M et al., *Emerg Infect Dis*, 2005)
- One emerging / re-emerging disease every 8 months.

**driving forces / determinants**

1. Change in nutritional & agricultural practices
   - Market demand for proteins of animal origin: X 2 from 2000 to 2020
   - In 2020: livestock = 50% of agriculture outputs (value) (source FAO).
   - Up to 2050: + 200 Mt/Y animal products + 1 Bt/Y plant products

2. 1980s-90s 2nd livestock revolution  
   (Delgado et al., 1999):  
   Intensive production systems  
   anti-infectious / high densities / suboptimum husbandry conditions  
   drop in genetic diversity /
infectious diseases in a changing world

**driving forces / determinants of emerging infectious agents**

1. **change in nutritional & agricultural practices**  
   (2nd livestock revolution)

2. **global change / climate change / natural disasters**

3. **population growth, ease to travel, social determinants**  
   (wars, loss of social cohesion)

4. **change in trade and food processing practices**  
   (news threats & risks)

5. **shifts in land use:**  
   accelerated urbanization / deforestation / encroachment on wild life  
   extensive a closer contacts “humans - livestock animals - wild life”

6. **weak link, capacity breakdown in public and animal health management**  
   to prevent, detect and respond to disease outbreaks

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**ecological challenge:**  
*dynamic interactions*: 1) quickly evolving pathogens, 2) granted access to new hosts and new reservoirs, …………… new favourable ecological niches

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**a conflict opposing “our wits versus their genes”**  
(Lederberg J, Science, 2000)
“One World, One Medicine, One Health”: chronology

- mid 90s: ↑↑ in global awareness of stakeholders (private & public sectors, lobbyists, media)
- 1995: launching of “EMERGING INFECTIOUS DISEASES” outbreaks: ebola, SRAS, avian influenza ......
- 2005 set up of
- 2004: suggested a comprehensive approach: “One World One Health®”

One Health Initiative

- accelerating biomedical research
- enhancing public health efficacy
- expanding the scientific knowledge base
- improving medical education and clinical care

a worldwide strategy for expanding interdisciplinary collaborations and communications in all aspects of health care for humans, animals and the environment.
“One Medicine One Health”

chronology of concept

- 2008: endorsement by FAO, OIE, World Health Organization, UN System, Influenza Coordination, UNICEF, World Bank
  
a strategic framework for reducing risks of infectious diseases at the animal-human-ecosystems interfaces

- 2010: tripartite concept note / strategic alignment
  
  vision statement: a world capable of preventing, detecting, containing, eliminating, and responding to animal and public health risks attributable to zoonoses and animal diseases with an impact on food security through multi-sectoral cooperation and strong partnership

- 2010: public health & animal health management capacities = global public goods
  
  “non rivalrous, not excludable, available worldwide”
One Medicine One Health

a broader scope for the “One Health” concept

- initially interdisciplinary collaboration among veterinarians, clinicians and ecologists
- historical focus on infectious diseases (zoonoses)
- chemical-associated illness: a promising domain for a One Health strategy

- toxicology & environmental health consistent with “One health”
  1. common environments
  2. common food sources
  3. human chemical exposure through animal products
     - (dioxin, laying hens)

- animal monitoring: a relevant way to prevent human exposure / for early detection of human illness
- wild, farm or companion animals as sentinels for human chemical threats

(Buttke D, J Med Toxicol, 2011)
areas for priorities  

6 objectives:

- **promote capacity building for surveillance** (all scales, according to international standards, tools and monitoring processes)
- **ensure adequate capacity in public and animal health to manage diseases outbreaks** (all scales, prevent, detect, respond & communicate)
- **ensure functioning national emergency response capacity** (and its support)
- **promote trans-agencies & cross-sectoral collaboration & partnership**
- **control HPAI and other potentially re-emerging diseases**
- **conduct strategic research**

**issues to be addressed:**

- sources & drivers of emergence,
- factors for spread, persistence, pathogen ecology
- epidemiology linked to socio-economic & policy research
- communications challenges, complexities of institution
- characterize pathogens in different farming systems at ecological interfaces
- tools for diagnosis, vaccines, therapeutics
in depth analysis of research needs

how does this translates into a research agenda?

- few indications on strategic approaches
- no analysis of the relevance of research on animals

2011 position paper

- challenges:
  - integrative biology systems biology
  - animal models / rodents + non-rodent
  - needs for monitoring intra-individual infection kinetics in BSL 2 & 3 facilities + non invasive technologies (medical imaging, recordings on whole organisms)
  - needs for biological & epidemiological models (maths + statistics to predict dialogs between hosts and pathogens, tissue behavior, organs interplay)
  - opportunities: genetically engineered animal models (developed for research purposes only)

(Ducrot C, Vet Res, 2011, 42-96)
future needs for research on animals

- Rodents will not cover all needs
- Livestock species could provide more relevance
  - Considered as a model
  - Considered as a target

**more holistic approaches**

Discourse on the Method (1637) by René Descartes

2nd principle: “to divide each of the difficulties under examination into as many parts as possible, and as might be necessary for its adequate solution”

- Facing the limits of analytical systems more in a whole system that the sum of its components

1st step: “omics” and signature recording (largely under exploited)

- One step further: improve data mining tools and strategies, develop data-reconciliation research: a promising field in applied maths
  - RNAseq: finger prints of pathogenomes, multiple DNAs bare coding
“One Health”: a strategy behind the concept?

- an action-oriented / action-driven initiative
  research: an applicative domain ............
  ............ researchers should drive their initiative within the concept!

- in France: a true opportunity to promote loyal, mutually beneficial, and synergistic collaborations between human and animal sectors / pathology and research

- tools to promote the initiative: “mixed research unit” / clinician PhDs

- examples: JPI in AB-resistance emergence, spread, management and anticipation