One Health Une santé

The Origins and Lineage of One Health, Part II

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In our previous column, we reviewed the progressive scientists and sociopolitical forces that contributed to One Health as we currently understand it. We described contributions of Claude Bourgelat (comparative pathology, 18th century), Félix Vicq D'Azyr and Edward Jenner (comparative medicine, late 18th century), Robert Koch and John Snow (disease transmission and epidemiology, 19th century), and Rudolph Virchow, James Cabell, Frank Billings, and Daniel Salmon (late 19th to mid-20th centuries). In this column, we follow One Health into the present.

The Guinea Pig Era

The Federal *Food, Drug and Cosmetic Act* (1938) and the *Nuremberg Code* (1947) gave rise to the "Guinea Pig Era," i.e., extensive animal testing (1,2). The 1938 *Act* required animal testing for demonstrating improved clinical outcomes and safety before pharmaceuticals were marketed and required comparative medicine to inform human studies (2). Biomedical scientists pivoted towards a narrow range of lab animals and focused exclusively on human health (3). There were notable achievements in human medicine, including many viral vaccines from chick embryos (4). In 1966, the United States Congress passed the *Animal Welfare Act,* preventing the sale of commercial animals for research (5), although exempting rats, mice and birds purposely bred for research. Biomedical research used a few lab species and collaborations between physicians and veterinarians declined, creating disciplinary silos that remain (1). Research and ecology dissociated, reducing connections between components of One Health and creating silos that remained at formation of the One Health office in the Center for Disease Control (CDC).

Despite the uncoupling of human and veterinary medicine, the role of ecology in disease was recognized. Karl Friedrich Meyer advocated for integrating ecology, i.e., the interaction between an organism and its environment, into veterinary medicine (6). Meyer believed that human disease could effectively be studied in lab animals (7), but supported research into bio-ecological, environmental, and social determinants of disease (8).

With California's parrot fever epidemic killing humans, Meyer's studies of psittacosis in 1930s Los Angeles altered disease investigation. He determined that budgies and parrots could transmit the disease even when asymptomatic, and that psittacosis was introduced into California from wild-caught birds imported from Australia that shed the pathogen when stressed. California's climate was ideal for raising birds, an important income source for poorer residents. Meyer understood the socio-economic consequences of a blanket cull, and as an alternative, certified psittacosis-free aviaries and taught biosecurity. He emphasized socio-economic and environmental aspects of disease combined with lab-based studies (8), encouraging scientists to interact with other disciplines to understand the broader context of health issues.

Creation of the Center for Disease Control

The CDC was established in 1946 (9), by the United States Congress to provide technical support for malaria control (10). From its inception, the CDC differed from the National Board of Health (NBH) by providing technical support through laboratory expertise, consulting with state public health officials, and participating in epidemic control (10). In 1947, the CDC acquired the Public Health Service Plague Suppressive Lab which became its epidemiology division (11). In the same year, the CDC also established a Veterinary Public Health (VPH) division, which aimed to protect human and animal health and recognized the importance of environmental health as an extension of VPH (11). Like Friedrich Meyer's observations, the CDC noted that land use and expansion into wild areas created public health risks for humans and animals (9). With these 2 divisions and recognition of environmental health, the CDC was already adopting foundational ideas implemented by Lonnie King (9) to create a One Health office.

In 1951, Dr. Alexander Langmuir became the CDC's first chief epidemiologist (9). Unlike its predecessors, the CDC had the resources and expertise to provide laboratory and epidemiological support for public health practitioners and researchers (11). With ample resources, strong political support, and the ability to collaborate effectively with state and local authorities, CDC epidemiologists successfully contributed to domestic and international disease investigations. The CDC's work under Langmuir gained recognition and demonstrated the importance of a national health organization (9); furthermore, by supporting local governments in health crises, the CDC gained credibility.

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By the mid-20th century, the United States had experienced several epidemics, including typhoid fever (1906), H1N1 influenza (1918), diphtheria (1921), and polio (peaked in 1952). In 1951, Langmuir founded the CDC's Epidemic Intelligence Service (9). Epi-Aids, its public health investigations, were conducted at the request of US states and federal agencies (10). Epi-Aids determined that a 1955 outbreak of polio in vaccinated children was due to improperly inactivated viruses from 1 laboratory (9). Langmuir confirmed the efficacy of vaccines from other laboratories and restarted vaccinations. Epi-Aids' recommendations promoted health infrastructure, especially for populations with health disparities (10).

The CDC supported public health responses across the country, influenced policy, and placed CDC VPH officials in 41 US states, goals previously unmet by Cabell and Salmon. Veterinary public health became recognized as important in managing public health, especially zoonoses.

One Medicine

The CDC's Epi-Aids and VPH divisions influenced how disease and health were approached in the United States (10). In 1984, the term "One Medicine" was coined by Calvin Schwabe in the 3rd edition of Veterinary Medicine and Human Health (3). Schwabe was a veterinarian, epidemiologist, and public health advocate (12) who saw human medicine as focused on treating disease and advocated for veterinary medicine as defining health in terms of the population (herd) and focused on disease prevention (13). With the One Medicine approach, Schwabe imagined that reconciling human and veterinary medicine's views of health would benefit both human and animal populations (12). One Medicine grew from previous ideas and events and merging One Health components.

Although human, environmental, and animal health issues had previously converged (e.g., Germ Theory), One Medicine focused on collaborations between 2 elements: biomedical and veterinary research (3), likely due to the inception of One Medicine during the Guinea Pig Era and its reductionism (13). New approaches, e.g., genomics and molecular biology, were inherently reductionist, reinforcing disciplinary silos. Emerging in this context, One Medicine had a clinical focus and lacked the input of ecology and environmental health in One Health.

Although One Medicine combined the 2 elements, the greater number of medical schools and higher social status of physicians compared to veterinarians discouraged collaboration and gave the biomedical view that medicine had more influence regarding public health issues (14).

Whereas One Medicine regarded individual clinical issues, One Health regarded populations and public health. In their clinical focus, adherents of One Medicine often took a reductionist view of health, with a focus on studying lab animals, reminiscent of the Guinea Pig Era. In contrast, One Health's public health approach sought to understand humans and animals interacting with their respective environments. Indeed, as health came to be viewed in terms of populations rather than individuals, it became easier to identify and address interactions of animals and the environment. Alongside this shift in perspective, the late 20th century saw calls for more coordinated approaches to dealing with health crises.

Enter ecosystem health

Lester B. Pearson, Canada's 14th Prime Minister and prominent international mediator, received the 1956 Nobel Peace Prize. He was also committed to international development assistance, but not just financial; he believed that science and technology, adapted to the specific needs of communities, were important for international development (15).

> "Even when growth is satisfactory it cannot be divorced from its social consequences and some of these may be disruptive and disturbing. So, when we think of development, we must think of the state of society and not merely the state of the economy; of the effect of economic growth on social and cultural values, on the ecology and the environment." (16).

Pearson founded and was first chairman of Canada's International Development Research Centre (IDRC) in 1970; it promoted and developed the ecosystem (also Ecohealth) approaches to health. Ecohealth advocated transdisciplinary, community-based, systems-thinking research that considered environmental and social determinants of health, gender, and social equality, and ecological and social sustainability (17). The commitment to community participation and systems thinking allowed researchers to better understand the context — society, economy, and culture — in which disease was embedded.

Finally, Ecohealth practitioners were committed to bringing knowledge to action (18). Historically, One Medicine and its predecessors had focused, perhaps even fixated, on extensive research before taking action. The resulting gap between research-generated knowledge and its application in policy meant solutions developed in the laboratory were often too late or unable to adapt to fluid sociopolitical conditions. To bridge this gap, Ecohealth aimed to make knowledge gained from its multi-dimensional approach rapidly available for action.

The key features of Ecohealth are reflected in the United Nations Millennium Development Goals (MDG), which aim to improve health outcomes on a global scale by addressing emerging global public health challenges (19), including lowering child mortality, improving maternal health, and controlling diseases ranging from HIV to malaria. The declaration of the MDGs was signed in 2000 with a 15-year timeline for accomplishment.

One World, One Health

"One World, One Health," One Health's predecessor, was first introduced in September 2004 at a symposium organized by the Wildlife Conservation Society (WCS) and hosted by Rockefeller University in New York city. Human and animal health experts from around the world attended from organizations such as the World Health Organization (WHO), United Nations Food and Agriculture Organization (FAO), CDC, the United States Department of Agriculture, and the Canadian Cooperative Wildlife Centre (now the Canadian Wildlife Health Cooperative). These strategic thinkers developed the Manhattan

Principles, 12 recommendations for a more holistic approach to preventing epizootic disease and maintaining ecosystem integrity to benefit people, domestic animals, and ecosystem biodiversity (8,12,20). Initially, One Health focused on collaborative, transdisciplinary, and systemic approaches to infectious disease, with an Ecosystem Health approach that embraced the full scope of inter-relationships between people and natural systems.

Despite considerable debate over its definition, organizations collaborating under the banner of "One World, One Health" have made important strides in health systems. Collaboration among the WHO, FAO, and the World Organisation for Animal Health (OIE) during the mid-2000s resulted in: the Global Early Warning System, OIE/FAO Network of Expertise on Avian Influenza, and the OIE/FAO Crisis Management for Animal Health (21). These collaborations on global scales created a cascading effect that encouraged research integrating human, animal, and environmental health. In Canada, the Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) is an example of an integrated network monitoring antimicrobial use and resistance in Canada. It's a collaboration among the Public Health Agency of Canada, Health Canada's Veterinary Drug directorate, Canadian Food Inspection Agency, provincial Ministries of Agriculture, farms, abattoirs, and universities. This surveillance network acknowledges relationships among environmental, animal, and human health by including data from sick people and animals, and healthy animals on sentinel farms, abattoirs, and retail meat outlets (22).

In late 2008, the WHO, FAO, OIE, United Nations Children's Fund, and United Nations System Influenza Coordination all endorsed "One World, One Health." Despite its introduction to the global stage, organizations struggled to produce a definition (21). In 2009, conclusions from a meeting in Winnipeg were that organizations could interpret "One World, One Health" as they wanted. Consequently, researchers applied "One World, One Health" to their work to placate others, but continued to work in their respective silos (21). "One World, One Health's" long-term goals of healthy ecosystems and disease prevention were harmed by many who had short-term interests.

In 2009, Lonnie King established the One Health office in the CDC as the Director of Zoonotic, Enteric and Vector-borne diseases (23), facilitating contact among animal health organizations and the CDC, and increasing funding opportunities. Finally, after several attempts and the influence of socio-political changes, creative thinkers, and new ideas, Lonnie King's One Health office finally combined "One World, One Health" and united human/animal, environmental, and population health components under 1 banner.

One Health has since grown to overlap with the principles of VPH (zoonotic disease, food safety, and food security) and ecosystem approaches to health that address complexity of the interactions of determinants of health and socio-ecological systems (24). The current emphasis is on a transdisciplinary and collaborative approach to complex health challenges (including infectious and non-infectious chronic disease) to identify sustainable and resilient solutions that are equitable, just, and respect environmental limits.

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