THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
Popular article
July, 2026 Vol.6(7), 2120-2128

One Health And Veterinary Pathology: Protecting Animals, Humans And The Environment

Rashmi[1], Hemlata Chouhan[2], Pravin Bano[3], Renu[4]
[1]Assistant Professor, Department of Veterinary Pathology, CVAS, Jodhpur
[2]Assistant Professor, Department of Animal Genetics & Breeding, CVAS, Navania
[3]Assistant Professor, Department of Veterinary Pathology, CVAS, Bikaner
[4]Assistant Professor, Department of Veterinary Pathology, PGIVER, Jaipur
Corresponding author Email: *rashmi01meena31@gmail.com*
doi.org/10.5281/ScienceWorld.21617002

The One Health concept has become a globally recognized framework for addressing the increasingly complex interactions among human, animal, and environmental health. It is based on the understanding that the well-being of these three domains is closely interconnected, requiring collaborative and multidisciplinary approaches to effectively prevent and manage health challenges. In recent decades, the growing incidence of zoonotic diseases, antimicrobial resistance, environmental degradation, climate change, and biodiversity loss has highlighted the limitations of sector-specific strategies and reinforced the need for integrated health management. Consequently, the One Health approach promotes cooperation among veterinary scientists, medical professionals, epidemiologists, environmental experts, microbiologists, wildlife specialists, and public health authorities to develop coordinated and sustainable solutions. A key component of One Health is the implementation of comprehensive surveillance systems and preventive strategies that facilitate the early detection, monitoring, and control of emerging health threats before they escalate into regional or global emergencies. Veterinary pathology plays a central role within this framework by contributing to disease diagnosis, pathogen identification, outbreak investigations, and understanding disease pathogenesis in domestic animals, wildlife, and humans.

Keywords: One Health, Veterinary Pathology, Zoonosis, Emerging Diseases, Wildlife Health, Public Health.

INTRODUCTION

One Health requires multidisciplinary efforts at global, national and local levels, for the sake of our planet, mankind and animals. It was initiated at the American Veterinary Medical Association (AVMA) Annual Convention (2007) as launched by the American Medical Association along with AVMA and the Centres for Disease Control and Prevention. One health concept is governed by a great deal of interest as well as resources. To a certain level it is due to the greater popularity attained by the term population health. Successes up to a certain extent to provide understanding of socioeconomic gradients in health status at depth even though achieved, it has not yet led to sufficient development of corresponding policies that can effectively reduce the inequalities in health (Tsui *et al.*, 2010).

The increasing emergence of zoonotic diseases, environmental degradation, climate change, biodiversity loss, and antimicrobial resistance has highlighted the close relationship between animal, human, and ecosystem health. More than 60% of infectious diseases affecting humans originate from animals, and approximately 75% of newly emerging infectious diseases are zoonotic. These statistics emphasize the importance of coordinated efforts among veterinarians, physicians, ecologists, microbiologists, epidemiologists, and environmental scientists.

Veterinary pathology serves as the scientific bridge connecting these disciplines. Pathologists investigate diseases by examining tissues, organs, cells, and body fluids to determine the causes, mechanisms, and consequences of disease. Through necropsy examinations, histopathology, cytology, molecular diagnostics, and toxicological investigations, veterinary pathologists provide essential information that supports disease surveillance, outbreak investigations, food safety, conservation biology, and biomedical research.

WHAT IS ONE HEALTH?

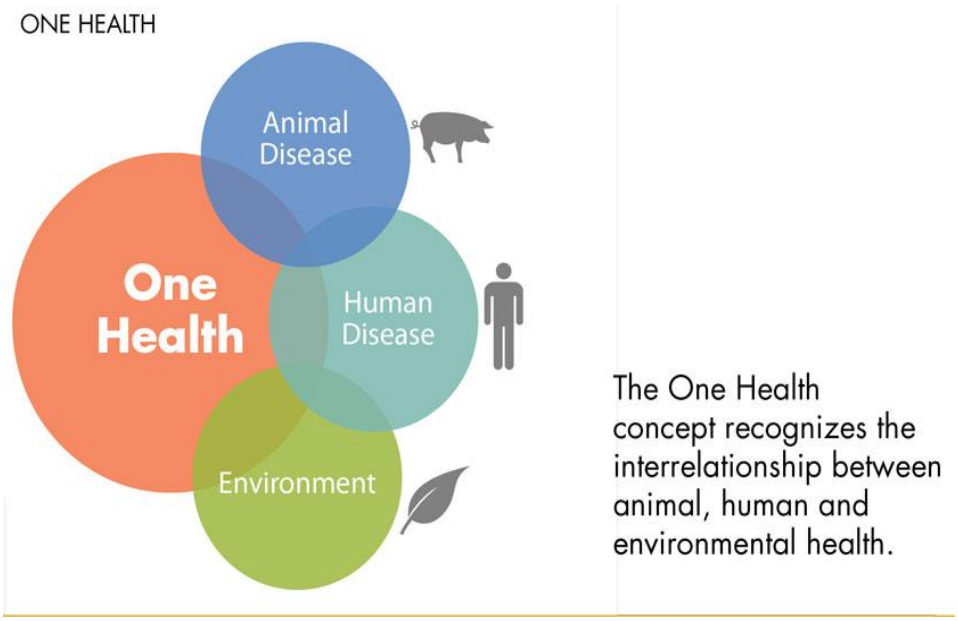
The One Health approach can also be viewed in a different context away from the zoonotic diseases and human-animal interface, wherein global concerted efforts are directed to prevent, control and if possible, to eradicate the diseases from planet earth. This has been shown for the smallpox in human and rinderpest in bovines.

Death of thousands of children and adults everyday worldwide due to underdiagnosed diseases arising at human-animal environment interface, explosive human population growth, and environmental changes have created the urgent need for a One Health approach on a global basis (Taylor *et al.,* 2001). One health approach requires the complex field of endeavour

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 25/07/2026

utilizing individual, organizational and cultural interventions, leading to improved morbidity patterns and health care use, behaviour of defined populations.

The animal and human health can be improved and enhanced within 'One Health' concept using innovative partnerships, collaborations, and research, surveillance, control programmes. The novel advances in diagnostics and therapeutics need to be explored to their full potentials to safeguard health of humans as well as their companion animals (Bergquist, R. 2011, Dhama *et al.,* 2012 a, Dhama *et al*., 2013b)



OVERVIEW OF VETERINARY PATHOLOGY

Veterinary pathology is a vital branch of veterinary medicine dedicated to the diagnosis, study, and understanding of animal diseases. It encompasses a wide range of disciplines, including histopathology, microbiology, and molecular biology. Veterinary pathologists play a crucial role in identifying and characterizing diseases in both domestic and wild animals, which is essential for effective treatment and management. Their work is not only pivotal in animal health but also contributes significantly to human health, particularly in understanding zoonotic diseases. The field is dynamic, constantly evolving with advances in medical technology and scientific knowledge, making it a critical component of veterinary science and animal welfare. Veterinary pathology delves into the mechanisms behind disease processes, providing insights into their development, progression, and effects on the body. By studying tissues, cells, and bodily fluids, pathologists can diagnose diseases and assess the health status of animals. This discipline is indispensable for the development of new treatments and

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 25/07/2026

preventive measures, contributing significantly to veterinary medicine's ability to improve and protect the lives of animals across the globe.

EMERGING AND RE-EMERGING ZOONOSES

The urgent need of various partnerships and collaboration lies in the critical difference in response to emergence and reemergence of zoonotic diseases that illustrate a new dependency, governed by the complexity of human-animal relationships, including wildlife (Jones *et al*., 2008; Cascio *et al*., 2011). New infection evolving due to change of an existing pathogen or spread of a known infection to a new geographic area or population, and diagnosing infection caused by an agent previously unrecognized, all contribute to the occurrence of emerging disease. Zoonotic diseases are those that animals use to transmit/ birds to humans under natural conditions (Office des International Epizootics, 2004). Out of 1415 species of pathogens in human, 868 (61%) are zoonotically important. The prevalence of infectious diseases has increased in last three decades with 175 pathogens causing emerging diseases with most of them [132 (75%)] to be of zoonotic nature (World Health Organization, 2009, Dhama *et al.*, 2012a). Surveillance data between public health and animal health organizations indicate an ever-increasing emergence of zoonotic diseases caused by pathogens resistant to antimicrobial substances viz., tuberculosis, campylobacteriosis, salmonellosis, E. coli and Staphylococcus aureus infections (Dhama *et al*., 2011; Kumar *et al*., 2012). Emerging and re-emerging diseases involve numerous mechanisms. Particularly, RNA viruses show extreme variations that act as a key factor for population of quasi-species to cross species barrier. Evolution of viruses is much quicker as they use mechanisms like point mutation and deletion; recombination and re-assortment along with acquisition of cellular genes. Also, the increase in widespread antimicrobial resistance among zoonotic bacteria limits the use of antibiotic treatments in animals. Emerging diseases may be the outcome of involvement of invasive/migratory species or release of foreign species accidentally in a new environment. Also, recent infectious disease events (severe acute respiratory syndrome (SARS), avian influenza(H5N1), swine origin influenza virus (H1N1) have uncovered vulnerabilities of the global health community in its preparedness and response to diseases emerging on the human-animal interface (Ali *et al*., 2012; Dhama *et al*., 2012a; Dhama *et al*., 2012b). Poultry meat is the major source of animal protein worldwide. So, people need to work or live with birds daily, exposing themselves to numerous microorganisms having the potential of zoonotic disease like Avian Influenza, tuberculosis, salmonellosis, campylobacteriosis, colibacillosis and chlamydiosis. In addition, listeriosis, Newcastle disease, eastern equine encephalitis, West Nile

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 25/07/2026

virus, cryptosporidiosis, erysipelas, clostridial infections, arizonosis, cryptococcosis, histoplasmosis and allergic alveolitis also contribute to human infections (Grunkemeyer, 2011, Dhama *et al*., 2012c).

IMPACT OF TRANSBOUNDARY DISEASES ON ONE HEALTH

Transboundary diseases include the epidemic diseases of highly contagious nature, which can spread very rapidly, irrespective of national borders, and are of much serious socio-economic and possibly public health concerns. These are the emerging and reemerging diseases which can cross borders between animals (domestic and wildlife) and human, and thus threaten both livestock and human health. This is another reason to combine all the latest research on economically important infectious animal diseases worldwide. No country whether rich or poor is immune from the risk of these disease, especially South Asian countries, which have been identified as a global 'hotspot' for emergence of infectious diseases of animal origin. The conditions that encourage the emergence of disease may be different, but the challenge of managing disease spread is almost the same for a given disease condition (National Research Council, 2005, Dhama *et al.*, 2012a). Improvement of health of man, animal and environment through One Health concept with special reference to control of emerging and zoonotic diseases at national, regional and global level becomes more critical with increased emergence of infectious diseases. Also, as these diseases can cross the animals-human-environment interface, studying in detail about the disease in one host species or environment alone may not be applicable for others; more researches are required on this area (Foreign Agriculture Service, 2003; Wolfe *et al*., 2005).

ROLE OF VETERINARY PATHOLOGISTS IN ONE HEALTH

Pathologists are an integral part of One Health as they are a critical component of the multidisciplinary team that diagnoses zoonotic diseases and discovers emerging pathogens. Both human and veterinary pathologists are uniquely positioned to identify clusters or trends in patient populations that can be caused by an infectious agent and preface emerging outbreaks. The repository of tissue samples available to pathologists is an invaluable resource that can be used to investigate a variety of pathogens. One Health is an encompassing approach that focuses on optimizing the health of humans, animals (domesticated and sylvatic), and the ecosystem, including plants, water, and vectors. Zoonoses are defined as infectious diseases that are spread between animals and humans through different mechanisms, including direct contact, food, water, vectors, or fomites. This review highlights examples in which human and veterinary pathologists were an integral part of the multisectoral team that identified

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 25/07/2026

uncommon etiologic agents or pathologies that had not been elucidated clinically. As the team discovers an emerging infectious disease, pathologists develop and validate tests for epidemiologic and clinical use and provide surveillance data on these diseases. They define the pathogenesis and pathology that these new diseases cause. This review also presents examples that demonstrate the crucial role pathologists play in diagnosing zoonoses that have an impact on the food supply and the economy.

ROLE OF PATHOLOGISTS IN DISCOVERING INFECTIOUS DISEASES

Pathologists have a critical role in discovering emerging infectious diseases by diagnosing new and unusual disease patterns and providing specimens that can define what the new pathogen is. In particular, infectious disease pathologists understand the pathogenesis of infectious agents and have knowledge of other tests that can be performed in tissues or other patient specimens to better define which microorganism is causing the disease process (Guarner 2014). Infectious disease pathologists are knowledgeable in microbiology and thus recognize the protection needed to process specimens and realize the regulations regarding the shipment of these specimens to specialized centres that can help identify these pathogens. Consultation with these subspecialists, whether inhouse or across the world, is indispensable to reach a diagnosis that can help the particular patient and, in case of a potential emerging infection, initiate public health measures, including reporting of the disease and epidemiologic investigation (Zaki *et. al*.2014).

ROLE OF PATHOLOGISTS IN THE DIAGNOSIS AND SURVEILLANCE OF ZOONOTIC DISEASES HUMAN AND VETERINARY PATHOLOGISTS

Pathologists have a critical role in the diagnosis of a multitude of zoonotic diseases. Although the clinical presentation of some of these diseases can be relatively specific, in others, the overlapping signs and symptoms require the use of diagnostic techniques, including microscopic study of tissues or tests performed in laboratories. The following examples shed light on the role pathologists have as diagnosticians, thus providing surveillance data.

CHALLENGES AND FUTURE DIRECTIONS IN VETERINARY PATHOLOGY

Despite advancements, veterinary pathology faces several challenges. One major issue is the need for more pathologists, especially those with expertise in exotic and wildlife species. Additionally, the field must keep pace with rapidly evolving diseases and emerging pathogens, requiring continuous learning and adaptation. Looking ahead, the integration of more advanced technologies like AI and precision medicine will be key. The field will likely see increased collaboration with other disciplines, emphasizing a One Health approach that recognizes the

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 25/07/2026

interconnectedness of human, animal, and environmental health. Addressing these challenges and embracing new methodologies will be crucial for the future of veterinary pathology. In the future, veterinary pathology is expected to increasingly focus on zoonotic diseases, given their significant impact on public health. The field must also address the challenge of antibiotic resistance, necessitating research into alternative treatments and preventive strategies (Sikkander 2022, Akhtar *et.al*., 2023) The role of veterinary pathologists in wildlife conservation and ecosystem health is becoming more critical, especially in the face of climate change and habitat loss. Embracing a more holistic, One Health approach, where the health of animals, humans, and the environment are seen as interconnected, will be pivotal in advancing the field and responding effectively to the global health challenges of the future.

CONCLUSIONS

Humans have been aware of diseases that pass from animals to them since they domesticated dogs. However, the One Health approach has provided the integration of veterinary and human medicine with environmental well-being. The approach is collaborative, multisectoral, and transdisciplinary and thus has been embraced by many organizations working at the local, regional, national, and global levels and should better prepare the world to discover and contain zoonoses and emerging infectious agents. The SARS-CoV-2 pandemic showed us that a novel microbiologic agent can appear suddenly and spread rapidly worldwide. It has also shown that, in addition to humans acquiring infections from animals, animals can be infected by humans continuing the spread and providing hosts where mutations of the agent can occur. The new mutations in the pathogen may make it more virulent, resistant to medications, or able to escape the immune system of the host, giving rise to a new emerging infection. Pathologists are an integral part of One Health as they can detect cases that are likely caused by an infectious agent, identify a cluster or abnormally high frequency of a particular syndrome in a patient population, and have tissue samples that can be used for study of various agents. Pathologists also develop and validate tests to define specific diagnoses for these diseases.

REFERENCES

Ahmed SS, Ersboll AK, Biswas PK, Christensen JP, Hannan AS and Toft N (2012). Ecological determinants of highly pathogenic avian influenza (H5N1) outbreaks in Bangladesh. PLoS One. 7(3): e33938.

Akhtar K, Ahmed I, Tipu MY, Yaqub T, Shahid M, ur Rehman A, Aslam A. Molecular identification and infection pathology of Mycobacterium spp. in captive wild animals in Pakistan. The Journal of Infection in Developing Countries. 2023;17(08):1107-1113.

Ali A, Khatri M, Wang L, Saif YM and Lee CW (2012). Identification of swine H1N2/ pandemic H1N1 reassortant influenza virus in pigs, United States. Vet. Microbiol. 158(1-2): 60-68.

Bergquist R (2011). New tools for epidemiology: a space odyssey. Mem. Inst. Oswaldo Cruz. 106(7): 892-900.

Bloom DE (2011). 7 Billion and Counting. Sci. 333(6042): 562-569.

Cascio A, Bosilkovski M, Rodriguez-Morales AJ and Pappas G (2011). The socio-ecology of zoonotic infections. Clin. Microbiol. Infect. 17: 336 342.

Dhama K, Chakraborty S, Mahima, Wani MY, Verma AK, Deb R, Tiwari R and Kapoor S (2013b). Novel and emerging therapies safeguarding health of humans and their companion animals: A review. Pak. J. Biol. Sci. 16(3): 101-111.

Dhama K, Mahendran M, Tiwari R, Singh SD, Kumar D, Singh SV and Sawant PM (2011). Tuberculosis in birds: Insights into the Mycobacterium avium infections. Vet. Med. Int. Vol. 2011, Article ID 712369, 14 pages.

Dhama K, Tiwari R and Singh SD (2012c). Biosecurity measures at poultry farms and thumb rules to avoid developing a serious zoonotic illness from birds. Poult. Punch, 28(3): 30, 35-36, 38, 51.

Dhama K, Verma AK, Rajagunalan S, Deb R, Karthik K, Kapoor S, Mahima, Tiwari R, Panwar PK and Chakraborty S (2012b). Swine flu is back again: A review. Pak. J. Biol. Sci. 15(21): 1001-1009.

Dhama K, Wani MY and Tiwari R (2012a). Surveillance/networking, prevention and control strategies for zoonotic avian pathogens in context to one health concept with particular reference to south-asia.

Foreign Agriculture Service (2003). -Trade Data. U.S. Department of Agriculture.

Grunkemeyer VL (2011). Zoonoses, public health, and the backyard poultry flock. Vet. Clin. North Am. Exot. Anim. Pract. 14(3): 477-490.

Guarner J. Incorporating pathology in the practice of infectious disease: myths and reality. Clin Infect Dis. 2014;59(8):1133e1141.

Jones KE, Patel NG, Levy MA, Storeygard A and Balk D (2008). Global trends in emerging infectious diseases. Nature, 451: 990–-93.

Kahn LH, Kaplan B and Steele JH (2007). Confronting zoonoses through closer collaboration between medicine and veterinary medicine (as 'one medicine'). Veterinaria Italiana. 43(1): 5-19.

Kumar R, Verma AK, Kumar A, Srivastava M and Lal HP (2012). Prevalence and antibiogram of campylobacter infections in dogs of Mathura, India. Asian J. Anim. Vet. Adv. 7(5): 734-740.

Myers SS and Patz JA (2009). Emerging threats to human health from global environmental change. Annual Rev. Env. Resources, 34: 223-252.

National Research Council (2005). Animal Health at the Crossroads — Preventing, Detecting, and Diagnosing Animal Diseases. National Academies Press.

OIE (2004). Chapter 1.1.1. General definitions. In: Terrestrial Animal Health Code, 13th Ed. OIE, Paris, 3-11.

Sikkander AM. Assess of hydrazine sulphate (N2H6SO4) in opposition for the majority of cancer cells. In Acta Biology Forum. 2022;10-13.

Taylor LH, Latham SM and Woolhouse MEJ (2001). Risk factors for human disease emergence. Phil. Trans. Royal Soc. B. 356: 983-989.

Tsui AO, McDonald-Mosley R and Burke AE (2010). Family planning and the burden of unintended pregnancies. Epidemiol. Rev. 32 (1): 152-174.

Wolfe N, Daszak P, Kilpatrick AM and Burke DS (2005). Bush meat hunting: Deforestation, and prediction of zoonotic disease emergence. Emerg. Inf. Dis. 11: 1822-1827.

Wolfe ND, Dunavan CP and Diamond J (2007). Origins of major human infectious diseases. Nature, 447: 279-283.

World Health Organization (2009). Data and statistics: Causes of death. Geneva: World Health Available.

Zaki S, Blau DM, Hughes JM, et al. CDC grand rounds: discovering new dis eases via enhanced partnership between public health and pathology ex perts. MMWR Morb Mortal Wkly Rep. 2014;63(6):121e126.