

VETERINARY PATHOLOGY

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Summary

Diseases of all kinds have afflicted humankind far beyond recorded history. It was humankind's quest to understand, prevent, and cure diseases that laid the foundation of medicine and pathology. The genesis of Veterinary Medicine and Veterinary Pathology parallel their human counterparts and have since developed into illustrious professions with a rich history. From butchers to highly trained and skilled professionals, veterinary pathologists and the field of veterinary pathology has continued to evolve and flourish into a well respected institution. Members are employed in a wide variety of institutions namely; diagnostic laboratories, government agencies, academia, and industry.

As the field of veterinary pathology evolves, so too do the tools of their trade. While, post-mortem and histological assessment of animals and tissue specimens are the fundamental tools of Veterinary Pathologist, new technologies are being discovered. Improved methods in diagnostic imaging and the rapid growth of molecular biology has enabled the Veterinary Pathologists to identify changes in pathogens and hosts at the cellular and molecular levels that could only be dreamed of a few decades ago. Of major importance to a disease control policy is the implementation of an effective disease surveillance program. Veterinary pathology is pivotal in surveillance as it can be

employed both in the field and in formal diagnostic facilities. Working in concert with laboratory diagnosticians, a field veterinarian uses basic clinical and pathology skills to identify a problem, determine the severity of disease and then attempts to provide a presumptive diagnosis. This veterinarian submits either the whole animal or tissue specimens to a trained veterinary pathologist. The Veterinary Pathologist further analyzes the tissue and incorporates information from other disciplines to provide a definitive diagnosis to the clinical veterinarian and if required, to regional and local governing bodies to further understand the pathogenesis of the disease and control its spread.

1. The History of Veterinary Pathology

Disease, regardless of the cause or source, has affected humankind long before recorded history. Archeological evidence in early man has suggested people living in that period were challenged by many of the same maladies that afflict people in modern day civilizations. Study of man's early remains show these people were indeed affected by nutritional deficiencies, plagued by infectious diseases and even wasted into cachexic states by malignant cancers.

As civilization evolved, so too did methods of habitation. In general, communities evolved from individual small family units, into small clusters of people that eventually grew into the large communities that formed the foundation of major cities of present day. During this progression, humankind's exposure to animals also increased. Animals were not only hunted for food but were increasingly being domesticated and hence, these animals were slowly becoming an essential constituent of the community. Cattle, and in particular oxen as well as horses were beasts of burden and were a welcome addition to the hard laborer. Horses also constituted the major vehicle of transportation in that day, and were only supplanted as the main source of transportation by automobiles in the early 1900's. Dogs assisted in hunting and protecting the community from unwanted visitors - whether these were man or beast. Cats were kept for companionship. Significantly, both dogs and cats were critical in pest control, a fact underscored by a rise in bubonic plague in 18th century London England following the erroneous destruction of dogs and cats in that city.

As populations grew, so did the understanding and treatment of disease. Initially, disease was thought to be a consequence of an offence to the gods and thus healing was intimately connected to spirituality. The infirm visited the temples and other places of worship for remedies of their afflictions, often administered by priests or holy men. It was during the time of the Greeks however, that manifestations and causes of disease were beginning to be separated from theology and lore. Some of the founding fathers of contemporary medicine living during the Hippocratic period tried to determine the source of ailments using basic principles of anatomy. Unfortunately, much of the early writing suggests that the understanding of physiology and organ function was flawed. The predominant belief that souls of the uncremated dead would "wander for eternity along the River Styx" meant that few human bodies were available to would be anatomists for dissection.

People such as Aristotle, and other visionaries at the time, encouraged animal dissection

to further understand medicine. Indeed, studies of animal physiology, development and anatomy were fundamental to the development of the science of zoology and likely provided insight into animal diseases. Moreover, disciples of the Hippocratic School, Heterphilos and Erasistratos who may also be considered founders of pathology also used animal dissection to improve their understanding of human anatomy and disease. It appears likely that these individuals' quest to understand human disease unknowingly set the foundation of veterinary pathology. Interestingly, it has been suggested that while many scholars during the Hippocratic period scoffed at the importance of veterinary medicine, they did believe comparative pathology to be useful.

While the field of pathology progressed through study by Galen in ancient Rome, furthered by people like Benivieni in Renaissance Europe, it was really Rudolf Virchow who is considered one of the true founding father of human pathology. He should be considered as a founding member of veterinary pathology as well, as some of the many pupils he instructed, became the earliest members of veterinary schools were involved with documenting in detail the anatomy and general pathology of animals. Virchow's description of tissue changes following injury detailed in cellular pathology is considered by many as one of the seminal advancements in contemporary medicine and pathology. Though he was a physician, much of his observation of disease and advances in the understanding of infectious disease occurred from visits to abattoirs. Indeed, he was instrumental in implementing macroscopic and microscopic inspection of meat by trained veterinarians. These individuals were considered the first veterinary pathologists in a slowly burgeoning field. Of interest, it is speculated that Virchow's curiosity in meat hygiene and belief that slaughter plants were fertile grounds to study disease may have flourished from introduction to facilities at a young age. Indeed many of his relatives worked as butchers in 19th Century Germany.

The 1800's did not prove to be a particularly stellar century for veterinary pathology. The recognition of veterinary pathology as a legitimate field was overshadowed by significant progresses in human pathology was making in descriptions of post-mortem changes. There was dearth of recognition in the veterinary field, yet many well-recognized national institutions were developing to advance human pathology. Hundreds of physicians practiced human pathology, but approximately only 30 people were involved in veterinary pathology. In Germany and Austria, however, several individuals were beginning to set the foundation for the new discipline of veterinary pathology. Individuals, such as Wilhelm Schutz, a protégé of Virchow, proposed that all necropsies be completed by a trained pathological anatomists (the term used in 19th Century Europe to describe pathologists) and follow a systematic protocol similar to procedures used by human pathologists. Similarly, Christian Fuchs drafted two books that described pathological anatomy and veterinary pathology. These tomes were considered important diagnostic guides for describing anatomical lesions and clinical symptoms presented by ill animals. Indeed, without people such as these, the growth veterinary pathology would have been more stunted.

As a profession, veterinary pathology continued to lag behind human pathology until the 1940's. During this time, there was a marked growth in the numbers of veterinary pathologists being trained in North America and Europe; a trend punctuated by the swift formation of three professional veterinary associations. As the numbers of practitioners

increased, so did the knowledge of veterinary pathology, a phenomena that continues to today.

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Bibliography

Crocker J. (2002). Molecular pathology in oncology. *Molecular Pathology* **55**, 337-347. [Describes the latest molecular techniques employed to identify genomic changes and the potential applications for diagnostic pathologists]

Innes J. R. M. (1969). Veterinary pathology: Retrospect and Prospect. *The Veterinary Record*, **85**, 730-741. [An excellent discussion on the development of the discipline of Veterinary Pathology]

Long E. R. (1965). The pathology of antiquity. *A History of Pathology*, 1-15. New York: Dover Publications Inc. [Provides insight into the burgeoning field of Human Pathology and animal dissection].

Saunders L. Z. (1996). Austria and Germany. *A Biographical History of Veterinary Pathology*. 37-55 and 127-221. Lawrence: Allen Press Inc. [A world-wide historical biography of veterinary pathologists].

Saunders L. Z. (2000). Virchow's contributions to veterinary medicine: Celebrated then, forgotten now. *Veterinary Pathology* **37**, 199-207. [Describes the impact Rudolf Virchow had on the advancement of human and veterinary pathology].

Slauson and Cooper (1990). Pathology – The study of disease. *Mechanisms of disease: a textbook of comparative general pathology*. 1-19 Baltimore: Williams and Wilkins. [This textbook explains the basic principle of veterinary pathology].

Snijders A. M., Meijer G. A., Brakenhoff R. H., van den Brule A. C. J., and van Diest P. J. (2000). Microarray techniques in pathology: Tool or toy? *Molecular Pathology* **53**, 289-294. [This provides information on microarray technology].

Tataryn J., Berezowski J. and Campbell J. (2007). Animal Disease Surveillance. Large Animal Veterinary Rounds. Vol. 7 (ed. Department of Large Animal Clinical Sciences, University of Saskatchewan). Issue 6. Montreal: SNELL Medical communications Inc. [This article provides an overview of basic principle of epidemiology used in Veterinary Disease Surveillance].

Taylor C. R. Shi S., Barr N. J., and Wu N. (2006). Techniques of immunohistochemistry: Principles, pitfalls and standardization. *Diagnostic Immunohistochemistry*, 2nd edition (ed. D. Dabbs), 1-43. Philadelphia: Churchill Livingstone Elsevier. [Provides detailed information on immunohistochemistry and other antibody based diagnostic technologies].

Weiss M. M., Hermesen M. J. A., Meijer G. A., van Grieken N. C. T., Baak J. P. A., Kuipers E. J., and van Diest P. J. (1999). Comparative genomic hybridization. *Molecular Pathology* **52**, 243-251. [An in-depth discussion of hybridization techniques used in diagnostic pathology].

Wilkinson L. (1992). Attitudes to animal health and disease in the ancient world. *Animal and Disease: an introduction to the history of Comparative Medicine*. 1-17. Cambridge: Cambridge University Press. [Discusses early animal disease and the paralleled development of animal medicine and comparative pathology]

Biographical Sketches

Richard R. E. Uwiera is the chief Veterinary and Comparative Pathologist at the University of Alberta, Edmonton, Alberta, Canada. His research focuses on the zoonotic potential and pathophysiology of cryptic microorganisms present in livestock and is also involved in research that spans the disciplines of Cardiology, Otolaryngology-Head and Neck Surgery, Animal Health and Biomedical Engineering.

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