

VETERINARY OPHTHALMOLOGY: OUR PAST, PRESENT AND FUTURE

L'OPHTHALMOLOGIE VÉTÉRINAIRE : PASSÉ, PRÉSENT ET FUTUR

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(conférence invitée présentée le 15 mai 2008)

SUMMARY

This presentation on comparative and veterinary ophthalmology is divided into three sections: (1) ophthalmology in its infancy up until 1900, and founding period from 1901 to 1960; (2) ophthalmology as we know it today evolved from 1961 to 1980, and became a premier specialty in veterinary medicine (1981- now); and (3) the future in ophthalmology.

Technology has had a profound effect on the development of ophthalmology with the discovery of the microscope and later on of the ophthalmoscope. Most of the early developments in veterinary ophthalmology occurred in Europe where schools of veterinary medicine had been established for decades. America was slow to recognize the specialty of veterinary ophthalmology, due to a lack of resources, time, and faculty devoted to clinics in the veterinary schools, and to additional constraints in small animal medicine and surgery. Veterinary ophthalmic pathology developed simultaneously and played a key role in clinical advances, resulting in the publication of significant textbooks on veterinary ophthalmology.

Between 1960 and now, the majority of veterinary ophthalmologists have continued to contribute actively to this discipline. Significant advances during this period include: (1) the creation of veterinary ophthalmology societies or associations; (2) the creation of certifying veterinary ophthalmology boards (colleges); (3) the introduction of veterinary ophthalmology programs in academia; (4) the creation of clinical residencies for board certification; (5) the rapid emergence of private referral practices in ophthalmology; and (6) the advancement of veterinary ophthalmology research worldwide.

With half a century of experience and significant progress, veterinary ophthalmology is facing a bright future with opportunities, along with potential difficulties. Our academic programs seem to have stalled in size while the number of private veterinary ophthalmology practices has exploded. Our capacities in clinical diagnosis and management of animal patients were greatly helped by the introduction of non-invasive imaging of the outer and deeper eye, as well as by the continuous development of new drugs. Human and veterinary ophthalmology are expected to benefit from further advances in both medical and surgical treatments. However, we need more research in breed-specific eye diseases, especially in dogs which appear second to man in the number of inherited eye diseases.

Key words: *veterinary ophthalmology, historical development, present situation, future.*

RÉSUMÉ

Cet article sur l'ophtalmologie comparative et vétérinaire est divisé en trois périodes. (1) Avant 1900, avec les prémices de l'ophtalmologie, et de 1901 à 1960 quand ont été développées les bases fondatrices; (2) l'ophtalmologie a acquis sa forme actuelle de 1961 à 1980 et est devenue une spécialité phare en médecine vétérinaire dès 1981; et (3) l'avenir de l'ophtalmologie. Les progrès en médecine humaine et vétérinaire dépendent au moins en partie de l'évolution de la société et de l'économie, associée aux progrès technologiques.

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Les progrès technologiques ont contribué de façon importante au développement de l'ophtalmologie, avec l'invention du microscope et ensuite de l'ophtalmoscope (Hermann von Helmholtz, 1850). Les premières avancées en ophtalmologie vétérinaire ont eu lieu en Europe où les écoles de médecine vétérinaire existaient déjà depuis des décennies. En France, Eugène Nicolas, vétérinaire de l'armée, a écrit trois livres sur l'ophtalmologie vétérinaire et comparative en 1898, 1914 et 1928. En Allemagne, l'ophtalmologie vétérinaire a pris son essor entre 1875 et 1910, à partir des écoles vétérinaires de Berlin, Stuttgart, Munich, et Vienne. Rudolf Berlin (1833-1897), ophtalmologue humain, a co-édité avec Oscar Eversbush (Munich) la première revue sur l'ophtalmologie vétérinaire (*Zeitschrift für vergleichende Augenheilkunde*) publiée de 1882 à 1893.

Après avoir terminé ses études de médecine, Josef Bayer (1847-1925) est devenu vétérinaire en 1874 et ensuite professeur à la Faculté Vétérinaire de Vienne. Bayer est surtout connu pour son ouvrage pionnier et exhaustif sur l'ophtalmologie vétérinaire, *Augenheilkunde*, publié en 1900, et réédité en 1906, 1910, et 1914. Aux Pays-Bas, Jakob est surtout connu pour ses deux livres, *Tierärztliche Augenheilkunde* (1920) et *Pathologische Anatomie des Auges der Tiere* (1927). Henry Gray (1865-1939), un des premiers praticiens de petits animaux à Londres (1887), a traduit en anglais la deuxième édition du livre de Nicolas *Ophtalmologie Vétérinaire et Comparée*, le premier ouvrage sur l'ophtalmologie du début du XX^e siècle !

Les États-Unis ont tardé à reconnaître l'ophtalmologie en tant que spécialité vétérinaire, à cause d'un manque de ressources, de temps et d'enseignants alloués aux cliniques dans les écoles vétérinaires, et des contraintes supplémentaires existant en médecine et en chirurgie des petits animaux. W. N. Sharp, médecin au *Indiana Veterinary College* et *Indianapolis City Hospital*, a écrit un petit livre intitulé *Ophthalmology for Veterinarians*.

L'anatomie pathologique en ophtalmologie vétérinaire s'est développée en même temps et a fourni des bases essentielles au développement de l'ophtalmologie vétérinaire clinique. Parmi les ouvrages significatifs, on note *Pathologische Anatomie des Auges der Tier* (Jakob 1927), et *Lehrbuch der Pathologischen Anatomie der Haustiere* (Kitt 1901, deuxième édition).

De 1960 à nos jours, la majorité des ophtalmologues vétérinaires ont continué de contribuer activement à cette discipline. Des progrès significatifs ont été accomplis durant cette période, tels que 1) la création de sociétés ou associations d'ophtalmologie vétérinaire ; 2) la création de certificats de spécialité en ophtalmologie vétérinaire ; 3) l'instauration de programmes d'ophtalmologie vétérinaire dans les études ; 4) la création de postes d'interne des cliniques pour l'obtention d'un diplôme en ophtalmologie ; 5) l'émergence rapide des cabinets privés spécialisés en ophtalmologie ; et 6) la promotion de la recherche en ophtalmologie vétérinaire dans le monde entier.

L'ophtalmologie vétérinaire entame le XXI^e siècle avec un demi-siècle d'expérience et de progrès significatifs derrière elle. Forte de ses bases solides, l'ophtalmologie vétérinaire peut se réjouir d'un avenir brillant, riche d'opportunités mais aussi de difficultés potentielles. L'expansion de nos programmes académiques semble s'être arrêtée, tandis que la création de cabinets vétérinaires privés spécialisés en ophtalmologie a explosé. Le développement actuel de l'imagerie non invasive des structures externes et internes de l'œil, depuis l'échographie (y compris Doppler) jusqu'à l'imagerie au laser, a largement contribué aux progrès réalisés dans le diagnostic clinique et la prise en charge des pathologies oculaires chez l'animal. L'ophtalmologie humaine et vétérinaire peut encore s'attendre à de nouvelles avancées dans la thérapeutique médicale et chirurgicale, notamment avec l'arrivée de nouveaux médicaments. Ainsi, les prostaglandines topiques (PGF) ont apporté des bénéfices significatifs dans le traitement du glaucome chez le chien. Il faut poursuivre la recherche sur les maladies oculaires spécifiques de certaines races, particulièrement chez le chien qui occupe la deuxième position après l'homme pour le nombre de maladies héréditaires oculaires.

Mots-clés : ophtalmologie vétérinaire, historique de la discipline, situation présente, perspectives.

INTRODUCTION

Comparative and veterinary ophthalmology, in this presentation, is divided into: I. Past or the beginning: pioneers in ophthalmology (which spans from the beginning until 1900 and our foundation (1901 through 1960); II. Present: (a) organization and growth (1961 through 1980); and (b) success as the premier specialty in veterinary medicine (1981- now); and III. Future.

The history of veterinary ophthalmology is relatively short, spanning about one and one-half centuries. The most important species in veterinary medicine, and indeed, early veterinary ophthalmology, was the horse, important as an animal for war, farming, and sometimes food. However, with the conclusion of World War I and the development of the automobile, the value and importance of the horse rapidly declined; fortunately other species including food and small animals became important for veterinary medicine.

Also, veterinary ophthalmology as well as veterinarians interested in ophthalmology greatly benefited from the training and expertise of early medical ophthalmologists who often viewed this new discipline as comparative ophthalmology. This synergist association between human and veterinary ophthalmology continues to this date.

THE PAST

Pioneers in Comparative Ophthalmology

Progress in human and veterinary medicine is, at least partially, dependant on advances in technology, social discourse, and economics. Wars can both stimulate and delay medical progress! Also a major factor in the development of human ophthalmology was cataract surgery and its effect on the restoration of vision and improved quality of life. Cataract surgery has continued to define this unique specialty in medicine and veterinary medicine to this date.

Technology also had a profound effect on the development of ophthalmology (as with all of medicine). The development of the microscope, along with improved fixation and stains, permitted advances in histology and pathology, critical foundations for clinical ophthalmology. In the early literature, luminosity of the eye of the dog and cat (tapetal or fundus reflex) was often described (Jean Méry, 1704; Paris; and Jan Evangelista Purkinje, 1823), and various explanations offered (Albert & Edwards, 1996). These observations may have stimulated investigations as to the basis of the fundus reflex, and development of the first ophthalmoscopes. The development of the ophthalmoscope by Hermann von Helmholtz in 1850 finally permitted examination of the deeper tissues of the eye and development of clinical ophthalmology in both human and veterinary ophthalmology. Charles Babbage of Cambridge also designed an ophthalmoscope before 1847 (cited by Thomas Wharton Jones in 1854), but it was widely challenged by his critics and

he never published his device! The development of the indirect ophthalmoscope followed ten years later with its inverted image (Epken 1951). With the evolution of both types of ophthalmoscopes and eventually fundus photography, descriptions of the different ocular fundus diseases begin to appear in the medical literature, and ophthalmology, as we know it, rapidly advanced.

While these advances were occurring in human ophthalmology, interest in comparative and veterinary ophthalmology was also starting. Most of early development of veterinary ophthalmology occurred in Europe where the schools of veterinary medicine had been established for decades (Magrane 1988). Many of the early contributors to veterinary and comparative ophthalmology were physicians, some of which became veterinarians.

Early veterinary ophthalmology texts predate the development of the ophthalmoscope by several decades. These textbooks include those by Urbain Leblanc (*Traité des Maladies des Veaux*, 1824), Johann Friedrich Müller (*Hanbuch der Veterinär Ophthalmologie für Thierärzte*, 1847), Blazhekovich (*Rukovodstvo po Veterinarnoi Oftalmologii*, 1887), A Vachetta (*Oftalmoiatria Veterinaria*, 1892), and Heinrich Möller (*Lehrbuch der Augenheilkunde für Tierärzte*, 1889). (Review in Magrane 1988).

In France, Urbain Leblanc (1797-1871) from Maisons-Alfort Veterinary School, and Eugène Nicolas (1867-1928), as a military veterinarian, authored three early books on veterinary and comparative ophthalmology (Nicolas & Fromaget, 1898; Nicolas 1908; 1928). As anticipated, the majority of the information was on the horse.

In Germany, development of veterinary ophthalmology spanned 1875 through 1910, and involved the veterinary schools on Berlin, Stuttgart, Munich, and Vienna. Veterinary ophthalmology instruction was also offered at the veterinary school at Dorpat (Estonia) beginning in 1891. Rudolf Berlin (1833-1897), as a human ophthalmologist, started teaching ophthalmology at the Veterinary College of Stuttgart in 1875. His majority contributions to veterinary ophthalmology were his students and a new but short lived veterinary ophthalmology journal with Oscar Eversbush (Munich) as co-editor (*Zeitschrift für vergleichende Augenheilkunde – 1882-1893*) (Magrane 1988). The Stuttgart veterinary school had three physicians teach ophthalmology and they included Rudolf Berlin, Gustav Schleich and Oscar Königshöfer. Unfortunately for veterinary ophthalmology the Stuttgart school closed in 1912 due to financial difficulties! After *Zeitschrift für vergleichende Augenheilkunde* ceased publication, Eversbush continued to provide abstracts of veterinary ophthalmology reports, for *Jahresbericht der ophthalmologie* from 1889 to 1911.

Heinrich Möller, a veterinarian and graduate of the Military College in Berlin, was one of the first veterinarians to contribute substantively to veterinary ophthalmology because of his book, *Lehrbuch der Augenheilkunde für Tierarzt*, published in 1889. Unfortunately he left academia in 1895!

Other noteworthy veterinarians teaching ophthalmology at the Royal Veterinary College at Munich included K.W. Schlampff (1861-1913) and Heinrich Jakob (1871-1941). Jakob moved to Utrecht in 1911.

Josef Bayer (1847-1925) was Professor of Surgery at the Vienna Veterinary College, having first studied medicine and then becoming a veterinarian in 1874 (Bayer 1914). He also would become one of the founders of veterinary ophthalmology and veterinary ophthalmic pathology. Bayer initiated a very large collection of *postmortem* eyes, and started the ophthalmology museum, which became famous under Otto Überreiter in Vienna. Bayer also served as co-editor with Berlin and Eversbusch of the first veterinary ophthalmology journal, *Zeitschrift für vergleichende Augenheilkunde*, in its last few years. Bayer is best known for his comprehensive and early veterinary ophthalmology book, *Augenheilkunde*, published in four editions starting in 1900, 1906, 1910, and ending with the last edition in 1914 (Bayer 1914). The Vienna Veterinary School has recognized Josef Bayer's contributions to veterinary ophthalmology with the Josef Bayer Gold Medallion awarded in 1968 to two American veterinary ophthalmologists, William G. Magrane and Seymour R. Roberts.

In Netherlands, early contributors to veterinary ophthalmology included W. C. Schimmel and Heinrich Jakob (from Munich in 1911). With the arrival of Jakob, veterinary ophthalmology rapidly developed and became a separate specialty in 1919. Jakob is best known for his two books, *Tierärztliche Augenheilkunde* (1920) and *Pathologische Anatomie des Auges der Tiere* (1927) (Jakob 1920). Hendrik Veenendall wrote another impressive text in Dutch, *Dictaat Veterinaire Oogheilkunde* (1954).

Veterinary ophthalmology in England was championed by George Coats (a physician; 1876-1915) perhaps best known for the retinal disease which bears his name, and Edward Nettleship (1845-1913) a veterinary surgeon who became a physician and colleague of Coats. Henry Gray (1865-1939), an early small animal practitioner (1887) in London, translated Nicola's second edition of *Ophthalmologie Vétérinaire et Comparée* into English starting the first book to provide ophthalmic information to many countries, including America, in the early 20th century (Gray 1914).

America was slow to recognize the specialty of veterinary ophthalmology, related directly to the limited resources, time and faculty in the veterinary schools devoted to the clinics with additional further constraints in small animal medicine and surgery. George E de Schweinitz (1858-1938) was a physician at the University of Pennsylvania who authored several papers in veterinary ophthalmic pathology. G. G Van Mater, a physician at the American veterinary College, wrote a small book, *A Text Book of Veterinary Ophthalmology*, in 1897; unfortunately the majority of information was based on man.

W. N. Sharp, as physician at the Indiana Veterinary College and Indianapolis City Hospital, wrote a small book, *Ophthalmology for Veterinarians* (Sharp 1913). The text concentrated on the

horse but offered some information in the dog and cat. His drawing on the canine fundus is quite inaccurate, noting a subalbinoid fundus, devoid of tapetal and nontapetal areas, and a most unusual optic nerve head.

Less we forget, Hilding Magnusson (1886-1957) was a Swedish veterinarian, and best known for his 1911 publication on progressive retinal atrophy in the Gordon Setter (Magnusson 1911). This was his only contribution to veterinary ophthalmology! Magnusson's early observations in the Gordon Setter and the pioneering studies by Parry in the UK during the 1950s formed the basis for subsequent PRA reports by several investigators including Keith Barnett, Lionel Rubin, Gus Aguirre, and Kristina Narfström.

Development of veterinary ophthalmic pathology occurred simultaneously and provided essential support to the clinical veterinary ophthalmology advances. Significant books published include: *Pathologische Anatomie des Auges der Tier* (Jakob 1927); *Lehrbuch der Pathologischen Anatomie der Haustiere* (Kitt; second edition; 1901); the chapter was written by K. W. Schlampff (Munich). Additional ophthalmic pathology chapters appeared in general veterinary pathology texts written in English, including *Veterinary Pathology*, (Smith & Jones, 1957) and *Systemic Pathology*, Volume 2, (Jubb & Kennedy, 1963). Leon Z. Saunders and Lionel F Rubin in 1975 published a splendid illustrated text, *Ophthalmic Pathology of Animals*, devoted totally to animal eye pathology (Saunders & Rubin, 1975).

Our foundation

During this period, the development of veterinary ophthalmology was led by veterinarians who became veterinary ophthalmologists trained mostly in medical schools or by the pioneers in veterinary schools in Europe. These advances were interrupted by two major world wars, and markedly delayed advances in our information base. New textbooks were published in veterinary ophthalmology, in addition to those already cited. André Rochon-Duvigneaud (1943) wrote in French, *Les Yeux et la Vision des Vertébrés* in 1943 (718 pages) which reminds me of Duke-Elder's Volume I - *The Eye in Evolution* (1958), and G.L. Walls' - *The Vertebrate Eye* (1942).

In 1953 Gyula Komár authored a textbook in Hungarian on veterinary ophthalmology, and in 1968 with László Szutter, wrote a larger text, *Tierärztliche Augenheilkunde*, which included all species (Kómár & Szutter, 1969)

Utto Überreiter published extensively in the German language in the 1930s on cataract surgery and lens luxation in dogs, but was not well known in America and other English speaking countries. His chapter, *Examination of the Eye and Eye Operations*, in the 1959 *Advances in Veterinary Sciences*, published by Academic Press, provided a brief summary at the advances in both small and food animals, and the horse in Vienna; and stimulated ophthalmology world-wide (Überreiter 1959).

There were additional textbooks during this time period which contributed to the veterinary ophthalmology foundation. They

include: Manuel U. Troncoso – *Gonioscopy* (1947); R.H. Smythe – *Veterinary Ophthalmology* (Smythe 1956 and 1958), and *Animal Vision – What Animals See* (1961); P Mintscheff, *Veterinarjana Oftalmogija* (Sofia; 1958); W. Stefaniak, *Okulistyka Weterinaryjna* (Poland; 1965); J. H. Prince *et al.*, *Anatomy and Histology of the Eye and Orbit in Domestic Animals* (1960); the first two books devoted to canine ophthalmology *Canine Ophthalmology*, (Magrane 1965) and *Diseases of the Canine Eye* (Startup 1969); and *Aspects of Comparative Ophthalmology* (edited by O. Grahn-Jones, 1965) from a symposium by the British Small Animal Veterinary Association.

THE PRESENT

This time period spans 1960 to present; and I'm certain everyone has had the pleasure and honor of knowing many these veterinary ophthalmologists who gave generously their knowledge and experience to advance the development of the specialty world-wide. This time period includes: 1) the initiation of the veterinary ophthalmology societies or associations; 2) the establishment of certifying veterinary ophthalmology boards (colleges); 3) the development of veterinary ophthalmology programs in academia; 4) the development of clinical residencies for board certification; the rapid emergence of specialty ophthalmology private referral practices; and 5) advancement of veterinary ophthalmology research.

The establishment of veterinary ophthalmology societies or associations, often under the umbrella of larger national veterinary medical associations, provided a forum for all veterinarians interested in animal eye diseases, and eventually expanded into the veterinary ophthalmology certification boards or colleges in several countries (Magrane 1988). The American Society of Veterinary Ophthalmology started in 1957 with an informal group at the annual meeting of the American Animal Hospital Association in Miami, Florida; veterinarians in attendance were William Magrane (first president), Harlan Jensen, Leonard Krawitz, C. Griffith, Ralph Vierheller, P. Olson, Seymour Roberts, and H. Simpson (Magrane 1988). The first ASVO meeting to adopt the group's constitution and bylaws was held later in the same year at the annual American Veterinary Medical Association convention in Cleveland, Ohio. The first ASVO scientific program occurred in 1958 in Philadelphia and the annual AVMA convention with sixty veterinarians attending.

Veterinary ophthalmology groups in other countries followed; and included: Australian Veterinary Ophthalmology Society (1975), Japanese Society of Comparative Ophthalmology (1980), International Society of Veterinary Ophthalmology (1980), la Société Française d'Ophthalmologie Vétérinaire (1980), le Groupe d'Etudes des Maladies Oculaires (1981), Canadian Association of Veterinary Association (1982), Italian Association of Veterinary Ophthalmology (1984), European Society of Veterinary Ophthalmology (1984), Swedish Eye Panel for Eradication of Hereditary Eye Diseases (1976), and the British Small Animal Veterinary Association

Ophthalmology Study Group (1976). More recent groups include the German Eye Panel, the British Association of Veterinary Ophthalmologists, the Société Française d'Etudes et de Recherche en Ophthalmologie Vétérinaire (1995), and perhaps a new group in Spain. These groups provided an annual forum for exchanging professional experiences, and quickly starting publishing annual scientific programs. These societies also provided the foundation for the development of board-certification colleges including the American College of Veterinary Ophthalmologists, European College of Veterinary Ophthalmologists, and the Latin American College of veterinary ophthalmologists. In the UK a certificate and diploma scheme was developed in veterinary ophthalmology in the 1970s.

In the 1960s the referral of animal patients from private practitioner to veterinarians in universities and in private practice was beginning to occur, and with this change the development of clinical specialties in veterinary medicine started. With initial approval (1969), probationary approval (1970), and final approval (19774) by the AVMA Advisory Board on Veterinary Specialties the American College of Veterinary Ophthalmologists was established. Other board-certification groups were established in other countries.

The vital goals or objectives of these certification groups was and continues to promote the specialty, conduct a significant annual scientific meeting, and lastly but perhaps most important, to develop and monitor veterinary ophthalmology residencies and conduct a comprehensive certifying examination. To develop high quality three-year veterinary ophthalmology residencies requires considerable effort, time and expertise by the mentors. Following the changes in human ophthalmology residencies in America in the 1980s, the ACVO started a one-month intensive basic science course open to all veterinary ophthalmology residencies world-wide (offered every other year in June). The first course was offered in 1994. Faculty members contribute their time without any costs. The residencies started in 1972 have gradually expanded and there are now about 70 + residents in the three-year programs in America. The total membership of the ACVO is now nearly 400.

In addition to the ACVO annual scientific meeting, certification examination, and the basic science course, the ACVO started its own journal, *Veterinary Ophthalmology*, in 1998, following the cessation of quarterly journal (1991-97) of *Progress in Veterinary and Comparative Ophthalmology* because of its new owner. The bimonthly *Veterinary Ophthalmology* journal has published about 600 articles to date, and was recognized by the National Library of Congress in 1990 (abstracts on Medline and available on PubMed). Starting with only ACVO support, the journal now has 10 co-sponsors, and is an international journal with editorial board members from several countries. Starting with about 300 subscribers in 1998, the journal has grown to nearly 1200 subscribers and is available as hardcopy as well as online. Wiley-Blackwell is the publisher. Editors-in

Chief have included Kirk Gelatt (1998-2007) and recently David Wilkie (2008 - present). This journal, published in full color at no costs to all authors, provides the only journal devoted to veterinary and comparative ophthalmology, international visibility for our specialty, and accounts for 80 + % of all the new veterinary ophthalmology articles yearly.

In reviewing the world literature, the first veterinary and comparative ophthalmology journal, *Zeitschrift für vergleichende Augenheilkunde* was published for a limited time (1882-1885 or 1893) in Germany with Bayer and Berlin as co-editors; later Eversbusch joined the effort.

In the 1960s the referral of animal patients from private practitioner to veterinarians in universities and in private practice was beginning to occur, and with this change the development of clinical specialties in veterinary medicine started. With specialization beginning in veterinary medicine in the 1960s and, in full swing, in the 1970s, colleges of veterinary medicine world-wide, started to markedly increase the size of their clinical faculties and offer new clinical programs. Veterinary ophthalmology was one of the very first specialties in most clinical departments; the ACVO was the third clinical specialty so recognized in America (Veterinary Pathology, Veterinary Radiology and Veterinary Surgery were the first colleges). With the ACVO established, veterinary schools were encouraged to establish formal veterinary ophthalmology sections or clinical services; ACVO approved residencies, and develop research programs. In general, there are at least two ACVO- Diplomates at most veterinary colleges; two Diplomates are required to have two ACVO-approved residents in training.

Private veterinary ophthalmology practices often pre-dated those in academia, and many academics in Europe also had private clinics too. The continued expansion in numbers of highly successful and profitable veterinary ophthalmology private practices is truly remarkable! In America one private practice group includes more than 12 ACVO Diplomates as well as nearly as many ACVO-approved residents in training. With nearly 400 ACVO Diplomates at this time, the majority of the ACVO is now in private practice rather than academia. This presents from the ACVO vantage point distinct opportunities but also challenges. The salary differences between the private practice veterinary ophthalmologists and those in academia has been an increasing problem, and faculty retention has suffered. The private veterinary ophthalmology practices attract many more clinical patients than academia, and can focus totally on patient case rather than dividing time among teaching, research, and other academic activities.

With world-wide recognition of the veterinary ophthalmology as one the premier clinical specialties, research programs were developed and in many case became very successful and productive. Many animal species have served as animal models for human eye diseases and new information from these efforts have undoubtedly benefited both man and animals. If supported by

the National Institutes of Health available research funds were considerable. Smaller but equally vital research support has been progressing from breed specialty groups (often focusing on specific eye diseases with their breed) and the larger national purebred associations. With support of the ACVO leadership, and under the leadership of Reuben Merideth, the ACVO Vision for Animals Foundation was developed several years ago, and is now regularly supporting several small (\$5K USD) research projects for ACVO-approved residents. Fortunately in some colleges, a few endowed faculty positions with emphasis on eye research were established in veterinary ophthalmology. At this time the majority of animal eye research is conducted in academia, in both veterinary and medical schools.

Hence, in the past more-or less 50 years, veterinary ophthalmology made significant advances as a clinical specialty, many national societies, several certification colleges, training programs, a global journal devoted to only ophthalmology, progressive and numerous private and academic ophthalmology practices, and productive research programs. Now what?

OUR FUTURE

With the experience of a half-century of significant progress, veterinary ophthalmology is now poised for the 21st century! With very good and impressive foundations, veterinary ophthalmology has a most bright future. From its genesis and development a century ago, veterinary ophthalmology will continue to benefit from changes in human or medical ophthalmology.

First, veterinary ophthalmologists are progressing nicely world-wide and our future is indeed bright. However, we need to do more and better! Dennis Brooks in an editorial in the journal, *Veterinary Ophthalmology*, in 1998 analyzed the number and authorship of veterinary ophthalmology articles from 1990 through 1997 (this predates the initiation of *Veterinary Ophthalmology*) (Brooks *et al.* 1998). During this time the number annually of animal eye-related publications remained relatively unchanged (range 40-86 yearly; mean; 57). Of the 445 eye-related publications during 1990-1997, the academic authors wrote 401 of these papers. Since the journal *Veterinary Ophthalmology* started, there were an addition 600 publications (1998-2007). In the ACVO the ratio of private practitioner to academic ophthalmologist has significantly changed from 1:1 in the 1970s to 1: 10 in 2007.

As the majority of publications arise from veterinary ophthalmologists in academia, how can we ensure our information base continues to expand in the future! Some suggestions are: 1) Invest in ourselves and our future! With the veterinary ophthalmology societies and colleges develop independent and tax-free foundations and other schemes to support research programs, i.e. board-certified resident research projects; 2) develop new special one-year fellowships for residents to focus on one

species or group of eye diseases; 3) Sponsor additional special issues in the journal. *Veterinary Ophthalmology*, which concentrate of a single species, disease, and other timely topics; 4) Recruit additional societies or groups to join the journal as co-sponsors and expand further the editorial board, and increase subscriber numbers, and 5) establish veterinary ophthalmology academies which concentrate on the unique academic opportunities and challenges.

As our residency program are the “entryway” into veterinary ophthalmology, we need to continuing expand and enhance these training programs. A goldmine of case material for scientific studies exists in our private practices and we need to “marry” in various ways the benefits of the private specialties with those in academia.

Technology has always had a profound effect on advances in ophthalmology in both human as well as veterinary ophthalmology. The portable slit lamp biomicroscope, indirect ophthalmoscope, and even phacoemulsification instruments have revolutionized veterinary ophthalmology. The current development in non-invasive imaging of the outer and deeper eye starting with ultrasonography (including Doppler) to the laser-based imaging, have greatly expanded our clinical diagnostics and management for our animal patients. In years past, the limits of these imaging techniques were millimeters (mm) and now measure angstroms (μ). As these instruments become common in human ophthalmology, their availability to veterinary ophthalmologists will increase. Optical coherence tomography (OCT) and high frequency ultrasound biomicroscopy (40-100 MHz) can image of the anterior chamber angle and sclerociliary cleft of animals. Other imaging technologies including Scanning Laser Ophthalmoscope (SLO) and Adaptive Optics (AO) can differentiate the different layers of the retina.

Advances in our medical and surgical treatments characterize human and veterinary ophthalmology. Just look at the technology changes in cataract surgery in man and animals. From active scientific debate on the feasibility of cataract surgery in dogs in the 1950s using the intracapsular lensectomy vs extracapsular cataract procedures to now phacoemulsification and intraocular lens implantation in the 1980s and 1990s. With our understanding of the role of the lens in primary narrow-closed angle glaucomas in the dog, should we consider prophylactic lens removal (phacoemulsification) to prevent angle closure in eyes with vision! For primary narrow angle glaucomas in dogs with pectinate ligament dysplasia, should we consider goniotomies (transection of these ligaments for at least 180°) to prevent further angle closure and prevent ocular hypertension. If ocular hypertensive occurs in these eyes months later following this surgery does this suggest the cause of the glaucoma is within the trabecular meshwork?

New drugs continue to be developed; canine glaucoma has benefited significantly from the availability of the topical prostaglandins (PGF). New drugs continue to be developed for the

glaucomas as these patients require long-term therapy and often combination therapy as the diseases progresses. A significant number of glaucoma patients become blind annually, and the prognosis for PACG patients is poor initially.

tPA or tissue plasminogen activator injected into the anterior chamber has changed our clinical approach to hyphema and excessive fibrin. In contrast to human ophthalmology, antibiotic resistance in corneal ulcerations in dogs and the horse has not occurred!

We need more research in breed-specific eye diseases, especially in the dog; the dog appears second to man in the number of inherited eye diseases. Only about 25 breeds of dogs have been studied to varying extent for inherited cataracts, and about 100 additional breeds appear predisposed to cataracts. The limited numbers of genes associated with cataracts in human has limited investigations (in contrast to retinal degenerations shared by man and dogs). Of the 20 or so breeds of dogs with the primary glaucomas, 13 breeds have been investigated, often only as case reports. The prevalence of the primary and secondary glaucomas in dog in North America are 1.9 % which compares to the estimated 1-2 % prevalence in man world-wide. Investigations of the corneal dystrophies in dogs are great opportunities.

The availability of DNA/gene blood and mucosa tests of eye diseases in the dog has markedly increased in the past decade. Most dog fanciers know about these tests and promote their use. With this test, normal, carrier and affected dogs can often be identified! Unfortunately some canine fanciers have stopped annual eye exams in preference to these tests, only to suddenly have other inherited eye diseases arise (usually cataracts). As we have witnessed in the Briard retinal degeneration, gene therapy has also become possible for other selected retinal diseases in the dog, and I anticipate these advances to continue! Gene therapy for selected glaucoma breeds awaits identification of the gene(s).

As our early veterinary ophthalmologists recognized, expanding and strengthening our research programs will benefit the specialty and improve the care of our patients. Combining the patients from the academic and private specialty practice provides a very large population for clinical studies of specific diseases, drug evaluations, and new surgery techniques. The largest sources of research support will continue to be the National Institutes of Health (animal models of human diseases) and pharmacological corporations.

Funding our own ophthalmic research should be increased from animal eye foundations contributed by veterinary ophthalmologists, clients of patients and others as well as from our ophthalmic colleges and societies ensures emphasis on important diseases and strengthening of our residency programs. I still believe all trainees in board-certification residencies, whether in private or academic centers, should conduct and publish a small research project during their three-year residency program!

CONCLUSION

The history of veterinary ophthalmology spans about 130 years and created a premiere clinical specialty world-wide. From the pioneers of Nicolas, Berlin, Jakob and others in the early 20th century, our foundation of animal eye information started. Many of the early contributors to veterinary ophthalmology were physicians interested in comparative ophthalmology, a legacy which still occurs.

Advances in veterinary ophthalmology started in earnest in the late 1950s and early 1960s as specialization in all of veterinary medicine occurred and referral of clinical patients to specialists became accepted. Ophthalmology societies followed to facilitate the exchange of information among interested veterinarians and scientific progress. Board certification became available in veterinary ophthalmology in America in the 1970s and

1980s; today board-certification in veterinary medicine is available in America, Europe, Japan and Latin America. A certificate and diploma program developed in the UK. With the success of private specialty practices, academic programs were markedly enlarged and ophthalmology residency programs developed. At this time about 150 veterinarians are in two or three year residency programs world-wide seeking certification in one or more the colleges. The journal, *Veterinary Ophthalmology*, developed in 1998 by the ACVO and expanded to include 10 + co-sponsors and an international editorial board, is in its eleventh year of publication and our "window" to the biomedical literature.

Veterinary ophthalmology books abound with nearly 40 texts published in the past two decades. Scientific advances in technology, biology and medicine continue to influence and foster progress in veterinary ophthalmology.

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