From Osler to Olafson
The Evolution of Veterinary Pathology in North America*

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SUMMARY

Most branches of biological science in North America developed first in the United States, and later were taught and practiced in Canada. An exception was veterinary pathology, which as a discipline taught in veterinary colleges and as a field of research, developed first in Canada, and from there crossed the border to the United States.

Pathology was first taught at the Montreal Veterinary College, founded in 1866 by Duncan McEachran, a graduate of the Edinburgh Veterinary College. From the outset, he formed a close association with the medical faculty of McGill University, permitting his students to attend the same classes in the basic subjects with the medical students. Eventually, the Montreal Veterinary College became formally affiliated with McGill University, as the Faculty of Comparative Medicine and Veterinary Science.

The McGill veterinary faculty was forced to close for economic reasons in 1903, but it left an enduring legacy, particularly in the field of veterinary pathology. The legacy, a novel concept in the 1870's, was that pathology was the cornerstone of a veterinary education; the place where anatomy, physiology, chemistry and botany met with the clinical subjects, and gave the latter meaning. This tradition was formed at the Montreal Veterinary College by the world renowned physician William Osler, North America's leading medical teacher, whom McEachran had invited to teach at the College in 1876 in addition to his duties in the faculty of medicine. Osler had studied with Virchow in Berlin and applied his methods of autopsy technique and of scientific inquiry to his teaching of both human and veterianry pathology at McGill.

Osler also undertook investigations into various diseases of domestic animals, at the request of McEachran, who doubled as Chief Veterinary Inspector for the Dominion Department of Agriculture.

Osler left McGill University in 1884. Only after that year did other North American veterinary schools adopt pathology as a discipline of instruction. However, by 1884, Osler had already left his indelible imprint on the students (both medical and veterinary) he had taught in Montreal, one of whom took over the teaching of pathology in the veterinary college. Another, who followed Osler's example and also studied in Berlin with Virchow, wrote the first book in the English language on veterinary post mortem technique in 1889.

By the time the United States Bureau of Animal Industry was founded in May 1884, and Theobald Smith hired as its first pathologist, Osler had already done research work on hog cholera (1878), verminous bronchitis of dogs (1877) and Pictou cattle disease (1883) among others. Thus, veterinary pathology was established as an investigative discipline in Canada before the B.A.I. was launched.

The contributions of William Osler in the field of veterinary pathology, both as a teacher and as an investigator of disease in pigs, cattle, horses and dogs are reported. The contributions to veterinary pathology of four veterinarians, who graduated from the Montreal Veterinary College, are identified. Through one of these four, W.L. Williams, Osler's influence can be traced in an unbroken sequence from Canada in the 1870's to the U.S.A. in the 1980's. These historical data are presented as evidence of Canadian priority in establishing the discipline of veterinary pathology in North America.

Key Words: History of Veterinary Medicine; Pathology, veterinary, history; Osler, William; McEachran, Duncan; North America, veterinary pathology.

RÉSUMÉ

La plupart des branches de la science biologique en Amérique du Nord furent d'abord élaborées aux États-Unis et subséquemment enseignées et exercées au

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Canada. Il n'en fut pas de même, cependant, de la pathologie vétérinaire qui, en tant que discipline enseignée dans les facultés de médecine vétérinaire et en tant que domaine de recherche, eut son origine au Canada et, de là, fit son chemin jusqu'aux États-Unis.

La pathologie fut d'abord enseignée au Montreal Veterinary College, institution fondée en 1866 par Duncan McEachran, diplômé du Edinburgh Veterinary College. Dès le début, il établit des liens étroits avec la Faculté de médecine de l'Université McGill, ce qui permit à ses étudiants de fréquenter les mêmes classes que les étudiants de médecine dans les matières fondamentales. Le Montreal Veterinary College devait subséquemment être intégré formellement à l'Université McGill pour devenir la Faculté de médecine comparée et des sciences vétérinaires.

La Faculté des sciences vétérinaires de McGill dut fermer ses portes en 1902 pour des raisons économiques mais elle laissa un legs durable, plus particulièrement dans le domaine de la pathologie vétérinaire. Le legs était un concept nouveau au cours des années 1870 à l'effet que la pathologie était la pierre angulaire de l'éducation en médecine vétérinaire; le point de jonction de l'anatomie, de la physiologie, de la chimie et de la botanique avec les sujets cliniques, conférant par le fait même un intérêt et une pertinence à ces derniers. Cette tradition fut créée au Montreal Veterinary College par William Osler, médecin de réputation internationale et le plus prestigieux professeur de médecine de l'Amérique du Nord que McEachran avait invité à enseigner à l'école de médecine vétérinaire en 1876, en sus de ses tâches à la Faculté de médecine. Osler avait étudié avec Virchow à Berlin et appliqué ses méthodes d'autopsie et de recherche scientifique à son enseignement de pathologie tant humaine que vétérinaire à McGill.

Osler entreprit aussi des études concernant diverses maladies affectant les animaux domestiques, à la demande de McEachran qui faisait également fonction d'Inspecteur vétérinaire en chef pour le Ministère de l'Agriculture du Dominion.

Osler quitta l'Université McGill en 1884. Ce n'est qu'après cette année que d'autres facultés de médecine vétérinaire en Amérique du Nord adoptèrent la pathologie comme matière d'enseignement. Cependant, dès 1884, Osler avait déjà laissé une marque indélébile sur les étudiants (tant en médecine qu'en médecine vétérinaire) à qui il avait enseigné à Montréal et l'un d'entre eux lui succéda dans l'enseignement de la pathologie à la Faculté de médecine vétérinaire. Un autre, qui avait suivi l'exemple d'Osler et avait également étudié à Berlin avec Virchow, écrivit le premier livre en langue anglaise sur les techniques de nécropsie vétérinaire en 1889.

Au moment de la fondation du United States Bureau of Animal Industry (B.A.I.) en mai 1884 et de l'engagement de son premier pathologiste, Theobald Smith, Osler avait déjà fait de la recherche sur la peste porcine (1878), sur la bronchite vermineuse chez les chiens (1877) et la maladie bovine de Pictou (1883) entre autres. C'est ainsi que la pathologie vétérinaire devint une discipline de recherche au Canada avant même que le B.A.I. ne soit fondé.

Les contributions de William Osler dans le domaine de la pathologie vétérinaire, tant comme professeur que comme chercheur sur les maladies des porcs, des bovins, des chevaux et des chiens, sont citées. Les contributions à la pathologie vétérinaire de quatre vétérinaires diplômés du Montreal Veterinary College sont identifiées. Un de ces quatre vétérinaires, W.L. Williams, permet de retracer l'influence d'Osler dans un enchaînement ininterrompu du Canada dans les années 1870 jusqu'au États-Unis dans les années 1980. Ces données historiques sont présentées comme témoignage de la priorité canadienne dans l'établissement de la pathologie vétérinaire en Amérique du Nord.

Mots-clés : Histoire de la médecine vétérinaire; pathologie, vétérinaire, histoire; Osler, William; McEachran, Duncan; Amérique du Nord, pathologie vétérinaire.

Ladies and gentlemen! Mesdames et Messieurs!

A.R. Gurney, a contemporary playwright, has said that an important part of living is being aware of what anthropologists call our tribal identity, our identity as a group, as distinct from our individual identity. His allusion to ethnic tribes is equally apposite to professional tribes. Thus, I'm in favor of trying to discover our professional heritage by looking back and exploring it.

This is a historically interesting year for veterinary pathology on this continent, and our meeting place here in Toronto makes it doubly so. Nineteen eighty-four marks 100 years since the death of Joseph Woodward, who published the first scientific paper in the realm of veterinary pathology in North America (1).

The report by Woodward, a medical officer at the Army Medical Museum in Washington, described the histopathology of pleuropneumonia in cattle, and appeared in 1870. However, it was a lone event and did not establish a foothold for veterinary pathology on this continent. Woodward did no further work in the field of veterinary pathology. He left no successors who were interested in veterinary pathology; none of the physicians who worked with him pursued work outside of human pathology. Serious work at the Army Medical Museum (now the Armed Forces Institute of Pathology) was not taken up again until the 1940's, i.e. 75 years later (2).

This year is also an important milestone for us because of another event that took place a hundred years ago. We are meeting today near the birthplace of a great pioneer who tilled in our vineyard, Sir William Osler, who left the faculties of medicine and of comparative medicine in McGill University in Montreal in 1884, to go to the medical school at the the University of Pennsylvania (3). He departed after eight fruitful years of teaching at the Montreal Veterinary College, (later the faculty of comparative medicine at McGill), in the course of which he established pathology firmly as a discipline of academic instruction in a North American veterinary school.

Although the years he spent in our field were few, his influence was profound. It readily crossed the American border — then as now a peaceful one — and endured long enough to ensure the perpetuation of the discipline in the United States.

I shall discuss how veterinary pathology evolved on this continent, with respect to both the teaching of the subject in veterinary schools, and the development of knowledge within the discipline as the result of scientific investigation. Veterinary pathology evolved as a subject of instruction in Canada, in a veterinary school whose principal thought it should be taught. It also evolved in Canada in the Dominion Department of Agriculture, where the same man, Duncan McEachran, thought that animal diseases should be investigated by pathologists.

McEachran had been a partner with Andrew Smith in the founding of the Ontario Veterinary College in Toronto in 1862. However, it soon became apparent to him that he and Smith held widely divergent philosophies regarding veterinary education (4). Smith's low standards resulted in third-rate education but attracted numerous students. McEachran (Figure 1) harbored lofty aspirations for the improvement of the veterinary profession.

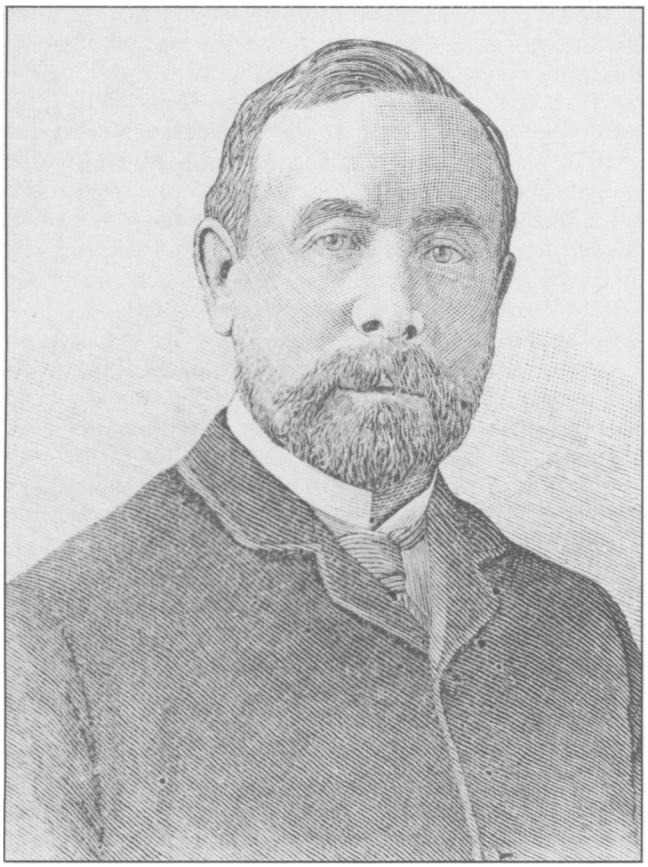


Fig. 1. Duncan McEachran, from an engraving published in 1888 (5).

These could only be realized by attracting bright students and providing them with a first-class education. He parted from Smith in 1864, moved to Montreal and in 1866 opened the Montreal Veterinary College as a private venture. We shall touch on McEachran several times in this paper, relative to pathology, but will not repeat the biographical information on him already published (5-7).

Dominion Department of Agriculture

In addition to his duties as principal and professor at the Montreal Veterinary College, McEachran was appointed Chief Inspector of Livestock by the Dominion government in 1876 and served until 1902. The Ministry of Agriculture opened a quarantine station — the first in the western hemisphere — at Point Levis, Quebec. By inspecting imported animals there, McEachran "... was successful in keeping Canada almost disease-free, despite epidemics plaguing cattle in the United States, England and Europe during those years" (7). It need occasion no surprise that McEachran set just as high a store on the services of pathologists in the investigation of disease as he did on their teaching in his college. As a result, he induced each of the McGill pathologists who taught his students to also investigate diseases: Osler on hog cholera and Pictou cattle disease, Johnston and Adami on the latter, and Adami also on tuberculosis. The tradition which McEachran began resulted in a veterinarian who had been trained by Adami, being appointed the first Dominion animal pathologist when Adami could no longer handle all of the work on a part-time basis. In the same tradition, carried on after McEachran's retirement, the Ministry of Agriculture employed S.B. Wolbach, a famous Harvard pathologist, to work on equine swamp fever during a year that he spent on the staff of the Montreal General Hospital (8).

I cannot go into detail here about the various diseases which McEachran set the pathologists to investigate. The publications resulting from this work are cited under the individual biographies. Of historical importance is that in Canada, such work began in 1876, and, by the time William Osler left the country in 1884, the discipline of pathology had been applied by a competent pathologist to several diseases.

By contrast, in the United States, the Bureau of Animal Industry was not founded *until* 1884, and its Division of Pathology not until 1891 (9). Moreover, when this division was organized, there was not a single trained pathologist within its ranks, and no tradition to employ the best pathologists in the country ever developed.

Teaching of Pathology in the Earliest North American Veterinary Schools

In the 1860's, institutions for the education of veterinarians had begun to appear in North America (10,11). The most important of them were founded by British veterinarians: Andrew Smith (Toronto), Duncan McEachran (Montreal), James Law (Cornell), C.P. Lyman (Harvard) were graduates of Edinburgh and Joseph Hughes (Chicago) a graduate of Glasgow. The dates of founding of the veterinary schools in the nineteenth century are shown in the table:

Teaching of Pathology in the Earliest North American Veterinary Schools

School and Date Founded		Years Pathology Taught and Names of Teachers
Ontario	1862	J. Caven, 1890-1899; D. Smith, 1900-1920
Montreal (McGill)	1866	W. Osler, 1876-1884; W. Johnston, 1885-1891; J. Adami, 1892-1902 [† 1903]
N.Y. Coll. Vet. Surg.	1864	J. Huddleston, 1895 [† 1899]
Amer. Vet. Coll.	1875	Not taught [† 1899]
Columbia	1877	T. Satterthwaite, 1881-1882 [† 1884]
Iowa State	1879	W. Harriman, 1895-1899
Harvard	1882	R. Fitz, 1882-1891; W. Whitney, 1892-1894; L. Frothingham, 1895-1902 [† 1902]
Chicago	1883	A. Edwards, 1894-1900; M. Herzog, 1906-1913 [† 1920]
U. of Pa.	1884	H. Formad, 1884-1891; R. Formad, 1892-1899
Ohio State	1885	Not taught in 19th century
Kansas City	1891	L. Rosenwold, 1894-1900; A. Kinsley, 1906-1918 [† 1918]
National	1892	V. Moore, 1894-1895 [† 1896]
McKillip	1894	O. Schwarzkopf, 1894-1901 [† 1920]
Cornell	1895	V. Moore, 1896-1902; S. Burnett, 1902-1914

†indicates when the institution closed.

The preceding table gives an indication as to which of the veterinary schools of North America taught pathology to the students in the nineteenth century and immediately after the turn of the century. I have not listed the smallest of the schools which perished after graduating only a dozen students, such as the University of California. Instead the table shows the schools which were important, either because they graduated thousands of veterinarians (McKillip, Ontario), or because they had high-class teachers even though the schools did not survive (Columbia, Chicago, Harvard). Almost without exception, the first teacher shown at each institution was a physician and in some cases the second one as well. The only veterinarians in the table are Frothingham, R. Formad, Kinsley, Burnett and Schwarzkopf.

Some of the physicians who taught pathology to veterinary students were well trained either in Germany, America or both. Others are so obscure that I have not been able to determine their qualifications. With the exception of the teachers at McGill University, however, none made any lasting contributions to veterinary pathology during the period 1865-1895. In several institutions, it appears that they taught the same course to the veterianry students and the medical students; the instruction in most cases consisted solely of lectures. A few autopsies were done, and reports were even published (12-14) so that the lectures were sometimes based on observations from domestic animals. But, the condition of specialist teaching of veterinary pathology in the nineteeth century in North Ameriaca was far behind the activity in Berlin, in Berne, in Munich, in Vienna and even in Kazan, Kharkov and Warsaw. In the latter, teachers trained in Germany taught autopsy technique and gross and microscopic pathology to an extent that would not be seen in most North American veterinary schools until about 1910 or even later (15).

Of the colleges which were founded in the 1860's, the New York College of Veterinary Surgeons did not include pathology in its curriculum. Neither did the American Veterinary College founded in 1875, with which the former institution later merged. During 1895, John H. Huddleston, a physician, served as professor of general and comparative pathology of the N.Y.C.V.S. (11,16), although there is no mention of this in his obituary (17). That year he reported on a case of neoplasia in the horse to the New York Pathological Society; the only evidence I have found of his veterinary activity (14). Since he had graduated from medical school only three years earlier and had no training as a pathologist, the impact of his brief fling on veterinary pathology, if any, was miniscule. Thus, this school, along with the contemporary Ontario Veterinary College, cannot compete with the Montreal Veterinary College as a center of activity in veterinary pathology during the 1870's, the critical decade when the discipline came to life in North America.

At the Ontario Veterinary College, founded in 1862, pathology was not part of the curriculum during the 1860's, 70's and 80's (4). Indeed it could hardly have been taught to the half literate students which Andrew Smith's low admission requirements attracted from both sides of the border. In the 1890's and later, there were lectures by J. Caven and D. King Smith, both physicians and the latter also Andrew Smith's son. The former was a bacteriologist. Smith wrote a couple of pedestrian papers on the submission of specimens for histologic study and on tumors (18,19), but pathology in his day was a course, rather than a department carrying on diagnostic or research activity. In the last three decades of the 19th century, serious teaching of veterinary pathology by qualified persons in Canada was being done only in Montreal.

In the United States just before and just after the turn of the century, pathology was taught well by Frothingham until 1902 when Harvard closed its doors, by Robert Formad, until he resigned his position, and possibly by V.A. Moore after he had learned the subject himself. Of these, only Frothingham, who had worked in Dresden with Albert Johne, was really well trained, and he left no scientific descendants.

Cornell initially (in 1868) did not have a school, but a one-man veterinary department, under James Law, which offered a four-year course. It graduated only five people, before it became a veterinary college in 1895. Pathology was not taught at Cornell until 1896 (20).

In the decade between 1877 and 1887, while Osler and Johnston were teaching pathology at the Montreal Veterinary College, Iowa State College commenced veterinary instruction in 1879. Like the course at Cornell,

the one in Iowa was also a small one-man operation, but in Iowa Milton Stalker offered a two-year rather than a four-year course. While Christiansen identifies this as the first "state supported veterinary college" in the United States (10), one wonders whether this novel definition of the word college is justified. In the 1890's, pathology was still not taken seriously at Iowa State; thus, the man hired as college physician was also responsible for teaching histology and pathology in the veterinary department (21). How a person untrained even in human pathology could teach these subjects without a microscope must be left to one's imagination. The history of the school records that as late as 1895, $100 was appropriated for the "Pathology Department." In 1895 when Dr. Harriman (the College physician) asked for $125 to buy a microscope, the trustees of the College demurred — they appropriated $15 to rent one for a year! In 1896, they finally relented, and appropriated the other $110 to consummate the purchase. Four years later, the annual budget for pathology was only $50 (21).

In the period which ended in 1884, pathology was taught by competent, well-trained pathologists only at the Montreal Veterinary College and at Columbia and Harvard Universities. However, Thomas Satterthwaite (22-24) and Robert Fitz (25), who taught at Columbia and Harvard respectively, did not make any original contributions to veterinary pathology. Even more to the point, they began to teach their veterinary students in 1881 and 1882, respectively, five and six years after Osler had begun to do so in Montreal.

I want to emphasize how few people were engaged in veterinary pathology in North America in the last quarter of the nineteenth century. Both as a discipline taught in the veterinary schools and as one practiced in state or federal government research laboratories, the continuity of veterinary pathology during this time was precarious.

The Montreal Veterinary College

In his Schofield Lecture in 1982, Nielsen said, "The Faculty of Comparative Medicine & Veterinary Science perished in 1903 after 13 years..." (26). But it did not perish without leaving a legacy, and it is this legacy that I wish to examine today. It had ramifications so far into the future that it can be traced to the 1980's.

In 1888, Mills, one of the teachers at the Montreal Veterinary College (later a faculty of McGill University), related the history of its first quarter century (Figure 2).

Fig. 2. The Montreal Veterinary College at 6 Union Avenue in 1895. (By permission of the Notman Photographic Archives, McGill University).

The veterinary students had to matriculate, i.e. have completed at least a high school education. They took their pre-clinical subjects, including pathology, with the medical students at McGill University. He added: "The College has a large museum well furnished with models, casts, skeletons, pathological specimens, etc."

Further, "The lectures and demonstrations in Pathology in McGill University are supplemented at the Veterinary School by special courses on entozoa and cattle pathology. The students of the College have also the opportunity of attending the autopsies on the human subject at the Montreal General Hospital and learning Virchow's methods of making post-mortem examination."

With respect to pathology, he wrote, "... the veterinary students are required to attend the same number of lectures and undergo the same examination as the students of human medicine of McGill University. At these examinations, some of the highest positions have been attained by veterinary students." (5).

The above would seem to be remarkable enough, and to give more than adequate indication as to why the dozen or so students who graduated from McGill each year were so outstanding. But there is more. One of the required courses was six months of histology; this in the 1880's! Mills mentions also two courses of six months each in chemistry and physiology, *with practical laboratory work* (italics mine). More than half a century later, in 1940, our course in physiology at the Ontario Veterinary College consisted solely of lectures, unaccompanied by any laboratory work.

Thus, the claim that the birth of veterinary pathology in North America took place in Montreal, is founded on both the teaching accomplishments of the three well-trained pathologists, Osler, Johnston and Adami, who taught it at McGill University and at the Montreal Veterinary College, and on the research contributions of the same three men and of their pupils. The fact that it began in Montreal was, of course, due to the foresight of Duncan McEachran, principal of the Montreal Veterinary College, who recruited Osler to his teaching staff (5,27,28). But let us think for a moment of veterinary pathology in the broader sense. In veterinary medicine, to a greater extent by far than in human medicine, pathology cannot be considered the exclusive preserve of specialist pathologists. It has always been important for practicing veterinarians to be able to conduct informative post-mortem examinations. It was particularly so in the nineteenth century when most veterinarians were concerned with farm animals. Viewed in this broader context, the supportive attitude of McEachran for pathology is just one more indication of how far ahead he was of his contemporary educators. Here is a most revealing passage, from his commencement address to the graduates of the Faculty of Comparative Medicine at McGill University in 1890:

"... in your practice acquire a habit of noting cases, record every case of more than passing interest, and study the subject carefully, read every available standard author on it, and in the light of knowledge so obtained, applied to the case under observation, you will soon become masters of your profession.

Never miss an opportunity of making a post-mortem examination; nothing aids a man so much in making a correct diagnosis as the repeated corrections and errors disclosed by a post-mortem examination. Never waste a pathological specimen; think how much good others may gain who succeed you as students of comparative medicine, from even one specimen, accompanied by a carefully recorded history. Museum specimens, accompanied by histories, are of great service in illustrating didactic lectures." (29)

In 1890, there were but few veterinary schools in North America, but I doubt whether there was another whose dean was likely to admonish his students "Never miss an opportunity of making a post-mortem examination." Thus, the fact that veterinary pathology on this continent sprang into life in Montreal stands revealed as no accident. It is what one would expect from a teacher who practiced what he preached, and who himself conducted autopsies, for example, of cattle afflicted with contagious pleuropneumonia (30). McEachran had advised his students in a previous lecture of the importance of the microscope in supplementing pathologic anatomic examination (31).

That was in Montreal, however. For the better part of two decades, from 1876 to 1895 the epoch-making scientific advances which were going on in pathology in Germany, and being taught in the veterinary schools of Europe, were ignored in Toronto and in most of the veterinary schools in the United States.

As already mentioned, William Osler, who first taught pathology to veterinary students on this continent, left Montreal in 1884 to continue his career as a teacher of medicine in Philadelphia. Veterinary medicine had been a concomitant interest of his, in which he pursued investigative work in parasitology and pathology and taught students. The beginnings of veterinary pathology as a discipline taught in universities and as a practical pursuit for the investigation of disease can be traced directly to him and to his students. In the 1930's, he had been dubbed the father of comparative pathology in Canada, by Charles Mitchell (32). However, my examination of the veterinary educational world in the 1870's, 1880's and beyond, has convinced me that Mitchell's claim was unduly modest. Osler is really the father of veterinary pathology in North America.

My purpose is to provide evidence in support of Osler's augmented title, and to show how veterinary pathology began in Canada and later spread to the United States. In tracing Osler's influence, I found that part of it was immediate, concerned with his pupils and with his investigative work. Some of it extended chronologically far beyond the 1870's and 1880's, and can be followed in an unbroken line, through his students to the present. Let us now pick up Osler's trail.

Osler's life has been the subject of a two-volume biography, and of innumerable short sketches, articles and bibliographies (3,33,34). His memory is so revered, and his essays and addresses have so preserved his charisma, that an Osler Society flourishes in North America, whose members are banded together to continue research on the influence of this unique physician. There is another one in England and one in Japan.

Osler was professor successively at McGill University, the University of Pennsylvania, Johns Hopkins University and Oxford University. I deal here only with his veterinary activities, most of which were carried out during his McGill period. Besides being a pathologist and an incomparable clinician, Osler was also a masterly historian and bibliographer of medicine. We can mention, but cannot enlarge on these aspects of his life; to do justice to them one must read Cushing's fascinating biography (3).

William Osler was born on July 12, 1849, at Bond Head, Ontario. This was "...at the edge of the great Canadian forest which in those days extended to within a few miles of Toronto" (35). One biographer wrote "During his long and active life he ...played the major part in initiating the greatest revolution in the teaching and practice of medicine — both human and veterinary; he had joined the laboratory to the clinic to help end empiricism" (35). Another wrote that Osler was "...judged by many to be the greatest clinician of our times" (36).

Osler attended the Weston School, near Toronto, and was a pupil of the Rev. W.A. Johnson, who was an ardent naturalist and microscopist. Cameron relates that his enthusiasm soon infected Osler. Through Johnson, Osler met Dr. James Bovell, professor of medicine at the Toronto Medical School, and also an enthusiastic naturalist. Osler spent part of 1867 in Trinity College, preparing to follow his father's career by studying theology. Under Bovell's influence, however, he changed to medicine and commenced his studies at the Toronto Medical School. By this time Osler had already become a proficient microscopist, and developed an interest in the entozoa. Murphy feels that the pattern for Osler's interest in comparative physiology, was set at this time, under the influence of Bovell, who also taught physiology at the Ontario Veterinary College. He writes that Bovell "...no doubt played a large part in forming Osler's ideas with regard to the ubiquity of disease in both man and animal" (28). Osler's first contact with veterinarians came when Bovell encouraged him to study internal parasites in the dissecting room of the Ontario Veterinary College; a room recently described by Barker (37).

Also influential in shaping the teen-aged Osler was Griffith Evans, who was stationed in Toronto as veterinary officer to the 4th Battery of the Royal Artillery. Evans had recently acquired a medical degree from McGill, while this unit had been stationed in Montreal. He was also an enthusiastic microscopist, who later became famous as the discoverer of *Trypanosoma evansi*, the cause of surra. Evans' biographers write that he took Osler "under his wing and gave him all possible encouragement" (38). They remained life-long friends.

In 1870, Bovell left Canada. Osler went to Montreal to continue his medical studies at McGill University, and graduated in 1872.

That year, Osler undertook advanced studies in Britain and on the Continent. In England, where he studied the blood of people and of various animals, he discovered the platelets in 1873; the first to see them in the circulating blood. When he moved on to Berlin, he encountered its stinking open sewers, which Virchow had just egged the city council into replacing. He waxed eloquent about Virchow, whom he called the master mind that attracts foreign students to Berlin. Obviously impressed with Virchow's intellect and indefatigable industry, Osler described in detail the various lectures, demonstrations and histologic courses in the Pathological Institute. He wrote:

> "Virchow himself performs a post-mortem on Monday morning making it with such care and minuteness that three or four hours may elapse before it is finished." (39).

His three-month sojourn in Berlin profoundly shaped his life, part of which then followed the footsteps of the master.

Osler moved on to Vienna, chiefly for clinical training, and wrote:

> "After having seen Virchow, it is absolutely painful to attend post-mortems here, they are performed in so slovenly a manner, and so little use is made of the material." (40).

The impression Virchow made was both profound and lasting. Almost two decades later, Osler said at the Virchow celebration at Johns Hopkins University:

> "Surely, the contemplation of a life so noble in its aims, so notable in its achievements, so varied in its pursuits, may well fill us with admiration for the man and with pride that he is a member of our profession." (41).

Upon his return to Montreal, in 1874, Osler was offered the post of lecturer in physiology, histology and pathology. The following year he was made professor, and appointed chief of the pathology laboratory at the Montreal General Hospital. He introduced the microscope and clinical chemistry into the hospital and into his teaching. Opie relates that he had but one microscope; however, he used a small salary from an appointment as physician to the smallpox ward of the hospital "to order from abroad a dozen Hartnack microscopes" (42). Bean also emphasizes that "His devotion to pathology and his real concern as a teacher are indicated by the fact that ... he purchased first-class microscopes for the use of undergraduate students at McGill." (43).

In 1876, Osler began teaching parasitology and physiology at the Montreal Veterinary College. Murphy writes "Osler was able to bring his famous 'bedside teaching' methods to the stables." (28). Sometime later he also undertook to teach pathology to the veterinary students, who were already studying human pathology with the medical students. Osler used human post mortem

material to teach the veterinary students, supplemented by animal material. He also exhibited lesions from cattle, horses and swine to the physicians at the Medico-Chirurgical Society in Montreal (44-46). His mind malready opened to the idea by Bovell (28), Osler had come to hold the view of comparative pathology which was put forth by Virchow. Nowhere in the world were physicians being taught Virchow's maxim, that there is only one medicine, more consistently or more effectively.

At meetings of physicians or veterinarians in Montreal, he exhibited pathological tissue specimens of disease from cattle, horses and swine as well as dogs — a wide spectrum of species for a day when cats were still ignored by veterinarians and sheep did not graze on the streets of this city.

In addition to his teaching duties, Osler delivered the inaugural address at the Montreal Veterinary College on two occasions. In 1876 his subject was "The relations of animals to man". He mentioned:

> "You will not be long students before you find out that similarity in animal structure is accompanied by a community of disease, and that the 'ills which flesh is heir to' are not wholly monopolized by the 'lords of creation'." (47)

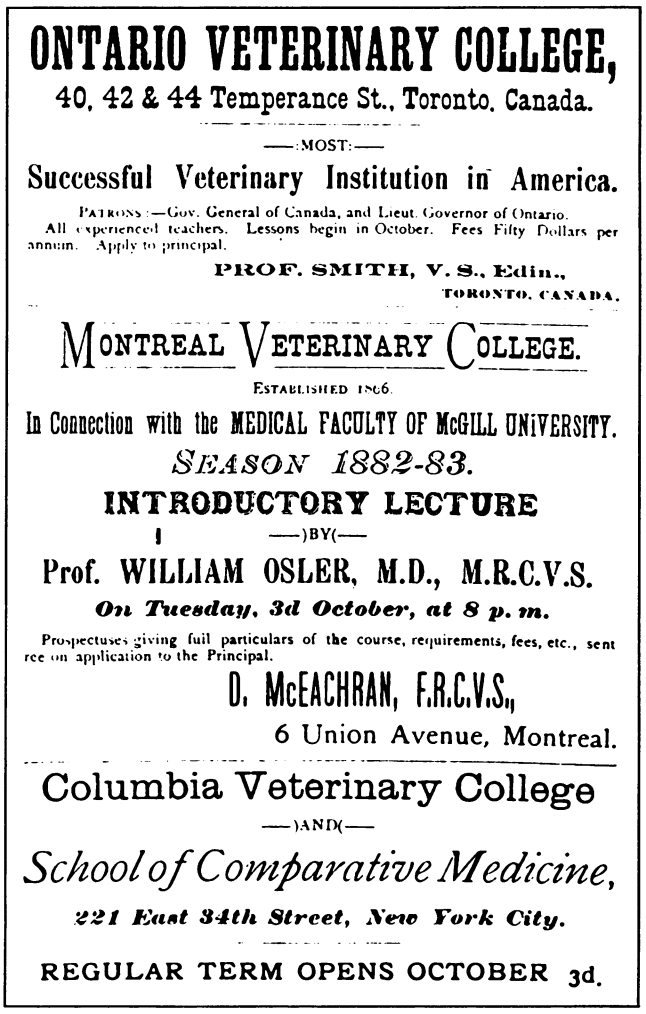
Osler (Figure 4) gave another inaugural address at the Montreal Veterinary College on October 1, 1878, on the topic "Comparative Pathology" (48). His hearers included the newly enrolled student Walter L. Williams of Argenta, Illinois, of whom we shall say more on a succeeding page. Osler defined pathology as "the physiology and microscopic anatomy of disease"; a broad and enlightened view in an era where many thought pathology was morbid anatomy. Williams apparently took careful notes or else had a phenomenal memory — he cited this definition correctly 65 years later!

In 1878, Osler was a quarter of a century away from his inaugural lecture at the University of Toronto entitled "The Master Word in Medicine", in which he defined this word as work! (49) But he was already shaping the idea in 1878, for he urged the veterinary students: ". . . to entertain a

> high appreciation of scientific study, to be regular in their attendance, to adopt a systematic apportionent of their time, and to take advantage of the opportunities afforded them while students here."

Although I have not found Osler's inaugural address at the Montreal Veterinary College in 1882, an advertisement of it appeared in the Journal of Comparative Medicine and Surgery in October of that year (Figure 3). This is on advertising page iv, facing text page 340, in volume III, no. 4, October 1882 with advertisements for two other veterinary colleges of which only one, the oldest, survives today, a century later. The principal of the Montreal Veterinary College, Duncan McEachran, has advertised the opening lecture of the session by Professor William Osler, M.D., M.R.C.V.S.

At the time Osler visited England, many North American physicians who took postgraduate work in England also crammed for the MRCP diploma. Cushing cites Osler as being against this at first but then later (in 1878) deciding to get his own MRCP after all (3). Osler did not, however, become a member of the Royal College



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SEASON 1882-83.

INTRODUCTORY LECTURE

—)BY(—

Prof. WILLIAM OSLER, M.D., M.R.C.V.S.

On Tuesday, 3d October, at 8 p. m.

Prospectuses giving full particulars of the course, requirements, fees, etc., sent free on application to the Principal.

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Columbia Veterinary College

—)AND(—

School of Comparative Medicine,

221 East 34th Street, New York City.

REGULAR TERM OPENS OCTOBER 3d.

Fig. 3. Reproduction of advertising page iv from the J Comp Med Surg, Oct. 1882.

of Veterinary Surgeons. I have this from the Secretary of the College, who wrote in June 1983, "I am at a loss to explain how the abbreviation M.R.C.V.S. came to be attached to Professor Osler's qualifications. I cannot find his name on any of our Registers either as a member or as an honorary associate or in any other category."

Why is he so listed in this advertisement? It is unlikely that he styled himself MRCVS on his own. Did McEachran do it, or was it a printer's error? Osler was not a surgeon and not a member of the Royal College of Surgeons. But if a printer were going to set a superfluous letter into the abbreviation MRCS by mistake, why would he pick a V, and why would he set it in the only place where it would result in a meaningful abbreviation? If the printer set only what he was told, why would McEachran, a man of unimpeachable probity, advertise a non-existent diploma, especially in a journal in which Osler himself was publishing case reports, and could therefore be counted upon to read the advertisement? I have been unable to come up with answers to these questions.

Osler's publications in the realm of veterinary pathology, while not numerous by today's standards, showed a considerable breadth of interest. His first paper,

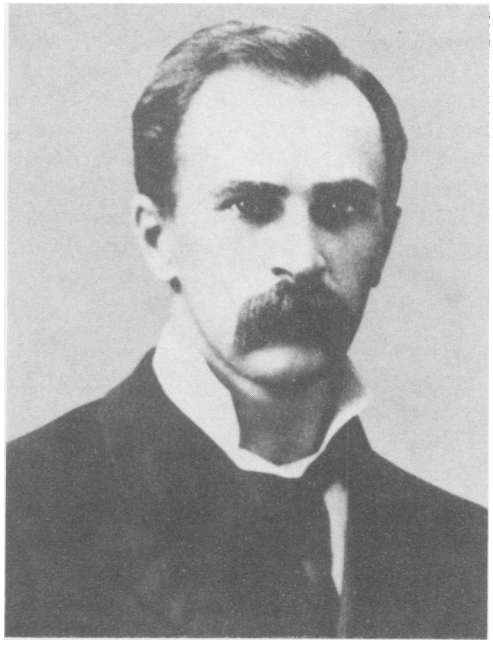

Fig. 4. William Osler, in 1881. (Courtesy of College of Physicians of Philadelphia).

on parasitic bronchitis in dogs, was excellent, and dates from 1877 (50). Having established the cause of a chronic respiratory condition in foxhounds at the Montreal Kennel Club by careful postmortem work, he named the disease properly, on the basis of its etiology and pathology. He did not succumb to the temptations of certain 20th century veterinarians, who adopted non-descript terms such as "kennel cough" for newly reported respiratory conditions.

His second research paper in 1878, on the pathology of hog cholera, was likewise an outstanding piece of work (51). Unfortunately, it was ignored by subsequent research workers in the Bureau of Animal Industry and elsewhere. A quarter century before the virus of hog cholera was discovered, Osler stated on the basis of histologic examination, that the disease was not attributable to bacteria. Had Theobald Smith, W.H. Welch and others heeded his report, they could have spared themselves years of futile arguments and bacteriological work (52).

Always interested in parasitology, Osler's investigation led him from human cases of infestation to the realm of meat hygiene. His mentor, Virchow had caused microscopic inspection of pork to be instituted in Germany in 1866, some eight years before Osler had come to study in Berlin. In 1882, Osler reported on three cases of human echinococcosis in the Montreal General Hospital. Wanting to know the prevalence of this disease in North America, he undertook a survey of museums, journals and unpublished cases of his correspondents. He worte (53):

> "I was led to make this in connection with an annual course of lectures on the parasites of man and the domestic animals which I give to medical and veterinary students. I could not ascertain, from any writings at my command, whether the disease was common on this continent or not. In this section of the country it is rarely met with, and in the inspection of over 800 bodies only three instances have been found."

He also wrote of making "casual visits to butcher stalls and to the shambles" to look for echinococci in meat. He sent a veterinary student to look for them: "One of my students, Mr. A.W. Clement, or Lawrence, Mass., examined 270 hogs at the Montreal abattoir and found 10 animals affected." (53).

Osler's most important veterinary student from our standpoint, Albert W. Clement, was quickly recognized by him as a bright person. He put Clement to work assisting him on several projects, which they later published jointly. They worked together on a study of parasites in the pork supply of Montreal, examining 1,037 hogs (54). Clement reported later that they had found cysticercus infection in 76 of them.

In 1883, Osler and Clement published case reports on bronchiectasis in a calf, on chronic bronchitis in a dog and pyometra in a bitch (55-57). It is apparent that Clement was assisting Osler in conducting autopsies on both large and small animals at the Montreal Veterinary College. That same year Osler and Clement also published on the experimental production of tapeworm cysts in a calf. They had conducted the experiment in order to have an actual model demonstrating the life cycle to show the medical and veterinary students (58).

This contact with the physician of genius, who had himself studied under Virchow, left a deep imprint on Clement's life and professional career. We will recount this shortly.

During his years of activity at the Montreal Veterinary College, Osler was also active in the Montreal Veterinary Association, serving as President during 1879 and 1880 (60). During one meeting he demonstrated a "verminous tumour" on the stomach of a horse, also showing the worms under the microscope (61). At another meeting, a practicing veterinarian reported on the symptoms of a horse which had been treated by its owner with a large dose of turpentine. He also described the lesions, found at "The post mortem examination, which was conducted by Prof. Osler . . ." who presided at the meeting. The stomach was passed around among the audience. This is perhaps the first instance of a clinico-pathologic conference in a meeting of a veterinary society in North America (62).

Osler still maintained an interest in veterinary medicine after he left Montreal in 1884, but his active participation in veterinary education ceased. During his years in Philadelphia, 1884-1889, he joined the editorial board of the Journal of Comparative Medicine and Veterinary Archives, and contributed occasional editorials (63) or translations from German journals to it (Figure 5). The year before his death in 1919, Osler still identified with the veterinary profession in a review of a book on horses for an Edinburgh veterinary journal.

After Osler's departure, McEachran was able to effect formal incorporation of the Montreal Veterinary College into McGill University, under the designation which Osler had proposed: the Faculty of Comparative Medicine and Veterinary Science.

THE JOURNAL
OF
COMPARATIVE MEDICINE AND SURGERY.

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VOLUME IX.

A. L. HUMMEL, M. D., PUBLISHER.
No. 224 South 16th Street, Philadelphia, Pa.
LONDON: BALLIERE TINDALL & COX.

Fig. 5. Title page of journal issued in 1888, with William Osler and Albert Clement on the list of collaborators.

Osler is thus established as the pioneer in North American veterinary pathology through: (a) his teaching begun in 1876; (b) his investigative work on verminous bronchitis in dogs in 1877, on hog cholera in 1878 and on Pictou cattle disease (59) in 1882; (c) a series of individual case reports between the years 1877 and 1884 (44-46,55-57,61-62); and (d) the work of his students, particularly Johnston, Clement and Williams.

Through having trained Johnston, Osler provided the continuity of teaching and the momentum to help McEachran keep the Montreal school open after 1884. In its last few years, it graduated Higgins and Blair. These men get us well into the present century, where their activities recounted elsewhere in this lecture leave Canada with a national laboratory of veterinary pathology, established in 1902, and the United States' largest zoo with a full time veterinary pathologist also appointed in 1902.

With these three men, however, the thread from Osler, either through his own students or through later McGill veterinary graduates would seem to be broken. Clement left no professional descendant, nor did Higgins or Blair. Each made his own contribution, and while these were enduring, they ended with the individuals just named. But there is one more man, a student of McEachran and Osler who graduated from the Montreal Veterinary College in 1879, and who conveyed Osler's influence, like the baton in a relay race, right up to the mid 1980's. That man is Walter L. Williams, of whom we shall hear at the end of this lecture.

Osler's Successors

Osler's successors as teachers at the Montreal Veterinary College were Clement, Johnston and Adami; the first two had also been his students. These men and Charles Higgins, a student of Adami's, were also Osler's successors as research pathologists for the Dominion Department of Agriculture. Another student of Adami's, W.R. Blair, was the first pathologist at the New York Zoological Society. Thus, an unbroken line of graduates of the Montreal Veterinary College and its successor institution had continued the teaching and practicing of veterinary pathology to the end of the nineteenth century. They require individual attention in order to bring Osler's lasting influence into focus.

Albert W. Clement

Albert W. Clement, Osler's most important veterinary student, was born in Lawrence, Massachusetts in 1857. He attended the schools of that city, and then pursued a pre-medical course at Harvard College for two years. He was obliged to discontinue his studies because of ill-health, and his physician advised him to seek an outdoor occupation (64,65). Busying himself with horses, Clement decided to study veterinary medicine. He entered the Montreal Veterinary College in 1879, and graduated in 1882 (Figure 6). We have already mentioned his selection

Fig. 6. Albert W. Clement, in 1882. (By permission of the Notman Photographic Archives, McGill University).

by Osler as a student assistant and cited some of their joint work. He remained at the College as a teacher for three years.

In his book "Oslerian Pathology" (66), Rodin illustrates a specimen of pleurisy from a fatal case of equine pneumonia which Osler and Clement had presented at the Montreal Medico-Chirurgical Society in 1882 (67). Rodin also shows specimens of verminous bronchitis in a pig and actinomycosis in a cow's jaw from the years 1877 and 1884. These were still in the McGill Pathology Museum in 1980. Although many of Osler's museum specimens had been lost in the century following his departure, the few which remained in 1980 included these three from his veterinary cases.

I have not discovered which subjects Clement taught during the years 1883-1885 that he remained at the Montreal Veterinary College after graduation. Parasitology was apparently one of them (68), but there must have been more. Osler had left McGill for the University of Pennsylvania in 1884. His successor in the Faculty of Medicine at McGill was Wyatt Johnston, who also taught pathology to the veterinary students after Osler's departure. Clement may have taught a clinical subject, assisted Johnston in teaching pathology, or very likely both.

Two obituaries state that during his years as a teacher at McGill, Clement was also employed by the Canadian government in investigating contagious diseases in animals (64,65). While I have been unable to confirm this, it is in consonance with the manner in which McEachran, in his capacity as chief inspector of livestock, employed Osler, Johnston and Adami.

In 1885, Clement published his first paper as sole author, and I believe also the first one on pathology by a veterinarian in North America. It dealt with the renal lesions in equine azoturia, and he refers with deference to an aspect of microscopic examination of the urine of the horse which Osler had called to his attention some time previously (69). Osler had demonstrated the gross lesions at a meeting of the Montreal Medico-Chirurgical Society (45). Clement's paper is a well-illustrated account of the histologic findings, of a scientific and literary standard which in 1885 had no counterpart from any teacher in any North American veterinary school. The lack of anyone with a comparable knowledge of pathology was particularly true of three veterinary schools then extant which have survived to the present: Cornell, Iowa and Ontario. It is interesting to read in Jones and Hunt's textbook a century later about the renal tubular necrosis; and to learn that the pathogenesis of azoturia is still not really known, although it has a better name: equine rhabdomyolysis (70).

In the spring of 1885, Clement went abroad for post graduate study in Europe and remained about a year. He studied and worked at the Royal Veterinary College in London, the National Veterinary School in Alfort, France, the pathological institute under Rudolf Virchow at the University of Berlin, the pathological institute under Wilhelm Schütz at the Berlin Veterinary College, and the central slaughter house in Berlin (71). Pathology is not mentioned in connection with Alfort, and Clement makes clear that no one is concerned with it in London. Most of the article describing his study leave deals with pathology in both the medical faculty of the University and in the Berlin Veterinary College. He writes admiringly of the correlation of the clinical findings with the lesions at the latter:

> "The clinical professor takes his class to the post mortem room and views the organs, pointing out as nearly as possible the relation between the lesions found and the ante-mortem symptoms. On three mornings in the week the pathologist demonstrates the morbid anatomy specimens, and once or twice a week gives instruction in the method of making post-mortems, but in addition to this the students in groups make post-mortems under the direction of the assistants."

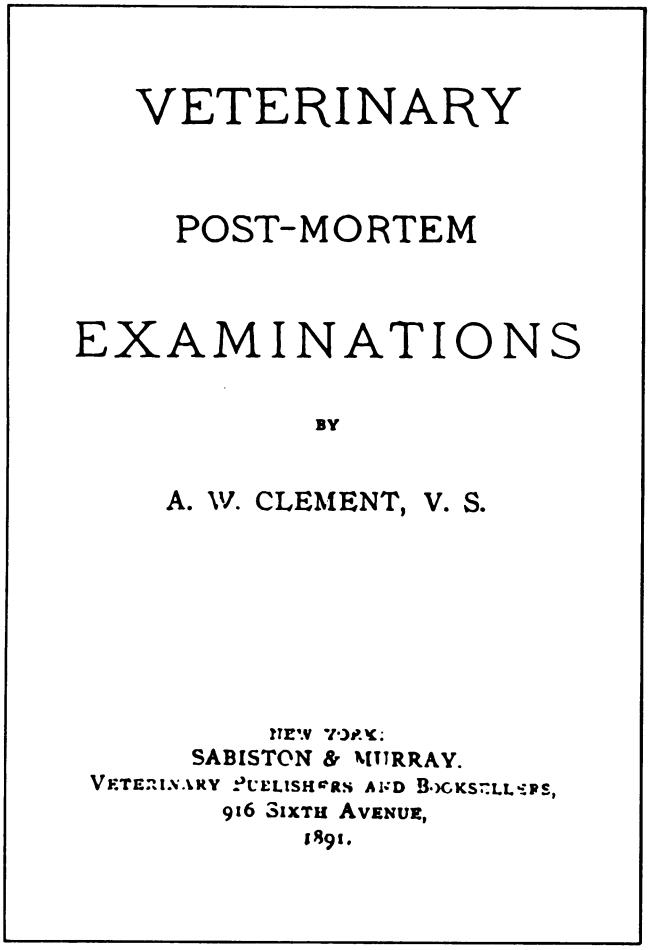
In Virchow's Institute, Clement saw essentially what Osler had seen eleven years earlier. At the central slaughter house, which employed 25 veterinarians, one of them a pathologist, he saw a great variety of lesions in food animals. When he returned to Montreal in 1886, he was undoubtedly inspired to apply his newly acquired knowledge, but he did not stay there long. For reasons I have not been able to ascertain, he left Montreal and moved to Baltimore to enter practice.

Clement's greatest contributions to veterinary medicine were his leadership in sanitary science, and in the American Veterinary Medical Association. I have dealt with these in another paper (72). His most important contribution to veterinary pathology is his monograph "Veterinary Post-mortem Examinations," the first publication on this topic in the English language (Figure 7). In fact, in a broader context, it was the first serious book in the realm of veterinary pathology in the English language (73,74). It appeared in 1889, as a chapter in a multi-volume reference book on the medical sciences; this was published as a separate book two years later (Figure 7). In the list of authors of the first publication, Clement is identified as being from the Bureau of Animal Industry, United States Government. I have been unable to determine the nature of this employment in the several historical publications of the B.A.I. In fact, his name does not even appear therein. However, at a meeting of the U.S.V.M.A., Clement once stated that he was a government inspector in the B.A.I. (75).

In the preface to his book, Clement writes:

> "Records of autopsies, to be of any value, should accurately represent the appearance of the tissues and organs so that a diagnosis might be made by the reader were not the examiner's conclusions stated. To make the pathological conditions clear to the reader, *some definite system of dissection is necessary*.." (italics mine).

He explains that he wrote the monograph because of the "The absence in the English language of any guide in making autopsies upon the lower animals..." In these prefatory remarks, Clement shows clearly the influence of his exposure to Wilhelm Schütz in Berlin during his sojourn there. A disciple of Virchow's, Schütz had been teaching systematic autopsy procedure since assuming the chair of pathology at the Berlin Veterinary College


VETERINARY

POST-MORTEM

EXAMINATIONS

BY

A. W. CLEMENT, V. S.

NEW YORK:
SABISTON & MURRAY.
VETERINARY PUBLISHERS AND BOOKSELLERS,
916 SIXTH AVENUE,
1891.

Fig. 7. Title page of Clement's book.

in 1870. Though advocating such a procedure may seem trite today, it was new when Clement introduced it to American veterinary medicine in 1889.

Clement described the technique for autopsy of the horse and modifications thereof for other domestic animals. He gave detailed instructions for examination of the central nervous system. He was obviously preaching what he practiced, since he had reported lesions of the C.N.S. in a paper antedating his book (76). He ended the book with a chapter on recording of autopsies, which began:

> "The description of the post mortem appearances should be objective. It is not sufficient simply to say that such or such disease is found, but the changes in consistence, color, size and shape which the diseased part presents should be objectively described."

Again, this sounds trite today, but to advocate this degree of rigor, in a day when most veterinary schools in the English-speaking world did not teach autopsy technique at all, and several lacked a teacher who could conduct an autopsy, was a decided step forward, perhaps even a revolutionary one. Three decades were to elapse before another and more detailed book on the subject appeared in English, and almost two more before systematic autopsies, including the C.N.S., were taught in many veterinary schools in North America.

Clement worked in pathology after he returned to the United States, doing research on hog cholera with William Welch at Johns Hopkins (75,77,78). All of his subsequent work, in practice, in disease control and in organized veterinary medicine, was based on the application of pathology to clinical and other problems. He served, as did Osler, on the editorial board of the Journal of Comparatiave Medicine and Surgery (later renamed Journal of Comparative Medicine and Veterinary Archives) (Figure 5). He published both original articles and reviews in its columns (69,79-85). Like Osler, he translated important articles, such as Kitt's new method of blackleg immunization, from German for this journal (86).

By any of several criteria, Clement was an outstanding veterinarian, and after Osler, the second of the pioneer veterinary pathologists on this continent. The latter is true despite the fact that he never held a post as a pathologist, and earned his living in private, large animal practice, combined with a part-time position as State Veterinarian of Maryland. By a happy chance for this North American audience, he was an American educated in Canada, so that we can cheerfully lay claim to him no matter which side of the border we hail from. Educated by Osler as a student and as an assistant, later exposed to the best in German veterinary pathology in Wilhelm Schütz's laboratory in Berlin, further trained by collaboration (on hog cholera research) with the famous Welch at Johns Hopkins, Clement was indubitably better versed in pathology than any veterinarian in North America in the last decade of the last century. His book, pointing the way to the future in veterinary pathology, and helping to shape this discipline, is the hallmark of the well-trained man.

Clement practiced pathology as an adjunct to his clinical work, which encompassed horses, cattle and sheep (79,80,84,85). That this helped to make him a better clinician goes almost without saying, especially to this audience. He reported much of his work in the periodical literature, else we would have no record of the amazing number of autopsies he performed, many of them worked up histologically. Having mixed with the leaders in medicine, he was at ease, and accepted, in medical circles, as his report on a case of human glanders, including the findings in both the human and the horse attests (81). It is also evidence of his comparative orientation, the imprints of Osler and Virchow, which he enunciated in his presidential address to the American Veterinary Medical Association (87).

Clement's life was regrettably short, in view of what he might have achieved in a few more years. He began his veterinary career by publishing on pathologic material with Osler while still a student. His interest in pathology never deserted him; near the end of his career, he published with another pathologist, W.G. MacCallum, Welch's successor at Johns Hopkins, the autopsy findings on a tuberculous lion (88).

During his lifetime, he studied under or worked with outstanding pathologists — Osler and Johnston in

Montreal, Virchow and Schütz in Berlin, and five years with Welch and MacCallum in Baltimore (89). Welch and another Johns Hopkins pathologist, W.T. Councilman, also attended meetings of the Maryland Veterinary Medical Association when Clement was a speaker and supported him during the subsequent discussions (90). Clement was instrumental in having Welch appointed to Honorary Membership in the AVMA in 1892. It is a pity that Clement was not offered a chair in pathology in a good veterinary school in the 1890's. He returned to McGill for Alumni reunions and for graduations (91), but he must have seen that there was not a future for his alma mater.

On March 3, 1901, Clement died of cardiac disease in the Johns Hopkins Hospital, of which his old friend and mentor William Osler was physician-in-chief (65). A career beginning with pathology and informed by it in everything clinical which he did later had been Osler's hallmark. The identical attribute characterized the life of his pupil, Albert Clement. The fact that this professional descendent of Osler's did not teach veterinary students after 1885, meant that he left no such descendants of his own in veterinary pathology. With his last report, on the tuberculous lion in 1900, Clement brought the Osler legacy of veterinary pathology into the twentieth century. It remained for others to bring it further.

Wyatt Johnston

After Osler's departure from McGill University in 1884, his appointment as head of pathology at the Montreal General Hospital, and as teacher of the subject at the University, was taken over by a young physician who had been a student of his (92). Johnston was born in Sherbrooke, Quebec, in 1863, and educated at Bishop's College in Lennoxville, Quebec. He entered McGill University in 1880 and graduated as a physician in 1884. He became interested in pathology while an undergraduate medical student, and assisted Osler at autopsies and in preparing gross specimens for demonstrations (93). To further this interest, Johnston went to Berlin in 1885, where he spent the summer working in Virchow's laboratory. The following year he returned to Germany, to work with Paul Grawitz in Greifswald, the pathologist who had first described the embryonal nephroma.

In 1885, Johnston was appointed demonstrator in pathology in the faculty of medicine at McGill, which also entailed teaching the veterinary students at the Montreal Veterinary College. To prepare himself further, he returned to Europe a third time to work on comparative pathology in Munich and also at the London Zoo. Although the year of his third trip is not given (93), it would have been while John Bland-Sutton, a noted comparative pathologist was the prosector at the Zoo. Johnston may have worked with Otto Bollinger in Munich. My inquiry at the Munich veterinary faculty whether Johnston had worked with Theodor Kitt, drew the reply that there is no record of his having done so.

In a lecture on methods of teaching pathology given in 1900, Adami, Johnston's successor, described how to improve the teaching of postmortem pathology: "... if, after the method pursued by my colleague, Wyatt Johnston, such students be given each an organ, be made to describe its appearance, to make or study sections from the same, to study the descriptions given by standard authorities kept for this particular purpose in the adjoining laboratory, and noting the descriptions to write a diagnosis stating how far the appearances correspond to or depart from the described state, then the postmortem-room becomes the first of all laboratories, the instruction there received the most valuable, whether from the point of view of pure pathology, or of the development of the good physician." (94).

It is apparent from this quotation that Johnston's teaching, like Osler's, was strongly tinged with the systematic approach that each had acquired from his European mentors. Once again, the veterinary students in Montreal were being taught pathology by a master, incomparably better trained than the teachers of most veterinary students elsewhere in North America. Only Fitz and Formad, at Harvard and Pennsylvania had comparable training in pathology during the period 1885-1891 that Johnston taught veterinary students in Montreal.

Like Osler before him, Johnston (Figure 8) was recruited by McEachran to do investigative work on Pictou Cattle Disease in 1891, and he published a report of his work the following year (95). In 1893 he presented a

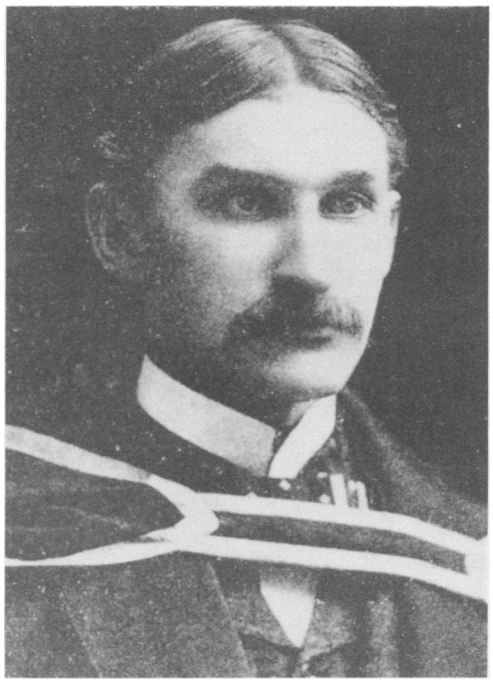


Fig. 8. Wyatt Johnston, about 1900. (Courtesy of College of Physicians of Philadelphia).

summary of this work, based on autopsies of 35 cattle, at the 30th annual meeting of the U.S.V.M.A. in Chicago (96). Johnston showed gross lesions at this meeting and made it clear that it was chiefly a disease of the liver, the counterpart of the lesion known in man as cirrhosis. Johnston was the first to describe the histologic lesions in the liver, and he confirmed Osler's previous finding of submucosal edema in the abomasum (59). Johnston reported that in cattle which had been ill more than a month, ulceration of the abomasal mucosa was present in addition to the edema.

Johnston was more active in veterinary medicine than merely having the veterinary students attend his course for the medical students would have required. He attended the meetings of the Montreal Veterinary Medical Association and participated in presenting cases and showing specimens of diseased tissue (97). He offered a cash prize to the veterinary student showing the greatest proficiency in post mortem and microscopic pathology (98). Proposed by Clement for membership, Johnston joined the U.S.V.M.A., gave a paper in Boston in 1892 on tuberculosis in a bull (99), and another one, on Pictou disease mentioned above (96). Immediately after joining the U.S.V.M.A., Johnston was appointed the corresponding secretary for Canada.

When J.G. Adami was brought to McGill from England to fill the newly created chair of pathology in 1892, Johnston gave up teaching this subject. I have not discovered why he had not been selected for the new chair. While teaching pathology, he had augmented and organized the museum specimens in the collection begun by Osler, which included material from domestic animals (100). At least three of these specimens were still in the McGill museum in 1980. Sometime after 1893, Johnston withdrew from veterinary activities. He had a distinguished career in bacteriology and forensic pathology thereafter and eventually was promoted to professor of hygiene at McGill (101). Unfortunately, he did not live very long to enjoy this recognition.

The obituary written by Osler related that Johnston died of pulmonary embolism from thrombosis of a femoral vein resulting from an infection (102). He described Johnston as a "genial, warm-hearted man, full of enthusiasm for his work...". He deserves remembrance in this lecture, because he continued to 1891 the tradition of high quality teaching of veterinary pathology in Montreal commenced by Osler in 1876.

J. George Adami

The third teacher of pathology at the Montreal Veterinary College, Adami (Figure 9) was born in England in 1862 and graduated as a physician from Cambridge University in 1890 (103). He was invited to occupy the first chair of pathology at McGill University in 1892, when that discipline was elevated to independent status. Esmond Long, the historian of American pathology, writes that during his tenure at McGill Adami was the outstanding pathologist in Canada and one of the leading pathologists on the continent (25). He became particularly well known for his monumental book

Fig. 9. J. George Adami, about 1897. (Courtesy of College of Physicians of Philadelphia).

"Principles of Pathology," published in two volumes in 1908 and 1909 (104). This and a revised edition became the standard textbook in North America for many years and was widely used elsewhere in the English-speaking world. He was a productive research worker in many fields of pathology and influential in training Canadian pathologists of the generation that followed him.

After Adami's arrival in Montreal, McEachran also recruited him to investigate Pictou Cattle Disease (105), and to work on tuberculosis for the Dominion Department of Agriculture (106-108). Adami taught the veterinary students, published papers on veterinary aspects of pathology (109-111), and above all, participated actively in the affairs of the Faculty of Comparative Medicine. He donated a prize of $50 each year, a large sum in those days, for original research in pathology. The winner was selected from students in both human and comparative medicine. In 1896 the prize was split between C.H. Higgins and R.H. Martin, one from each of these faculties (112).

In the university session which opened in October 1894, Adami gave the inaugural address to the new students in the Faculty of Comparative Medicine (113). He exhorted the veterinary students to mingle with their fellow students in the rest of the university, benefit from these contacts, and not become insular in their preoccupation with their profession. It is apparent from reading this address, that once again McEachran had succeeded in obtaining for his students a man of wide intellectual horizons, who would provide education rather than training, a physician, who like his two predecessors, Johnston and Osler, felt that veterinary

medicine was an integral part of medicine and spoke to veterinary students with affection rather than condescension. It becomes clear how exposed to teachers exemplifying such lofty aspirations, a seemingly endless array of veterinarians educated at McGill assumed positions of importance and leadership in their profession shortly after graduation.

Adami likewise attended and contributed to the meetings of the Montreal Veterinary Medical Association, and like Osler before him, served for a year as its president (114-116).

Adami taught pathology to W.R. Blair and C.H. Higgins while they were undergraduates, and to the latter also as a postgraduate. He also did research on Pictou Cattle Disease (105). His other contributions dealt with tumors (109,111), actinomycosis (110), glanders (117) and tuberculosis (118) in which he was especially interested. His paper on the teaching of pathology (94) reveals what a dedicated teacher the veterinary students in Montreal had.

During the period 1840 to 1898, bovine contagious pleuro-pneumonia caused serious losses in Great Britain. It was eventually controlled by prohibiting the import of cattle from countries harboring the disease. It had been stamped out in North America earlier than in Britain, in 1892, but the British embargo still remained. At a meeting of the Montreal Veterinary Association, in December 1893, Duncan McEachran spoke of the unfairness of continuing the embargo on Canadian cattle, which he said was based on "errors of judgment of officials of the Imperial Government" (119). He advocated the appointment of a scientist in England who would find "reliable means of arriving at a correct diagnosis." He stated that he and Professor Adami had examined microscopically tissues from the lungs of two cattle which the British inspectors had suspected of having pleuro-pneumonia, and in their opinion it was not that disease. Adami described the gross and histologic lesions of contagious pleuro-pneumonia, and stated that "... what the British veterinary inspectors call 'Canadian lung', but which Professor McEachran states would be more appropriately named transient pneumonia, ... is only seen in animals traveling by railroads or an ocean journey."

It is apparent that the British inspectors at the ports of entry were not familiar with the what was later called "shipping fever" in North America, and attributed to infection with Pasteurella bacteria. I seriously doubt whether the British inspectors, none of them trained in pathology, could distinguish between the two diseases, or for that matter between any kinds of pulmonary lesions. Although they were required to send tissues to Professor McFadyean in London for confirmation, it is not clear how often they did so. What is clear is that inspectors untrained in pathology would have been selecting which pieces of tissue to send in. The British government remained adamant and kept the embargo.

Some four years later, an editorial by John McFadyean, of the Royal Veterinary College in London, appeared in his own journal on the topic of pleuro-pneumonia (120). He complained that Adami had raised the subject at the meeting of the British Medical Association in Montreal, and had argued that the British authorities — with one exception — had not done any first class work. McFadyean did not attempt to refute this allegation by submitting evidence that the British diagnostic efforts were scientifically competent and, therefore, really did merit confidence. Rather he wrote: "Professor Adami set a bad precedent for scientific discussions when he resorted to disparagement of his opponents...". Perhaps therein lay the seeds of some later acrimony, reported below.

In a recent book, Iain Pattison has reviled Adami, who after World War I, returned to England and became Vice-Chancellor of Liverpool University (121). I do not know the merits of either side's case in the acrimonious exchange of correspondence between Adami and John McFadyean that began in "The Times" of London in June of 1920. In view of Pattison's attack, however, it is worth noting that no physician, pathologist or other, ever served North American veterinary students, Canadian veterinarians and the Dominion Department of Agriculture with more devotion and more effectiveness than J.G. Adami. He loyally supported the Faculty of Comparative Medicine at McGill until its last graduating class in 1903, and he made sure that the Dominion government would have a talented, Adami-educated pathologist (Higgins) when it opened its first diagnostic and research laboratory.

Nothing comparable to his superlative educational contribution and unwavering moral support can be identified elsewhere in veterinary schools on the North American continent up to 1903. With Adami, who died in Liverpool in 1926, we close the circle of men (Osler, Clement and Johnston) who during the quarter century 1877-1903, established veterinary pathology on this continent as a discipline which was first taught in Canada.

Charles H. Higgins

One of the most promising students to study in the Faculty of Comparative Medicine at McGill, Higgins was one of the numerous Americans who enrolled there. Born in Newtonville, Mass., on February 23, 1875, he was educated at the Massachusetts State College, graduating with a B.Sc. degree in 1893. He came under the influence there of Dr. James Paige, a McGill alumnus, who taught veterinary science (122). Paige was a good laboratory diagnostician, who some years after this time (together with two colleagues) identified the first cases of sporotrichosis in North America. He induced Higgins to enter McGill University.

Higgins showed his scientific interests early. Thus, the record shows him attending the meetings of the Montreal Veterinary Medical Association in his senior year. In the meeting of December 6,f 1895, he presented a paper on "Bacteriology and its Practical Application," including a historical resumé of the development of this science (123). At the meeting of December 20, he suggested certain scientific publications be added to the library of the Association. On January 15, 1896, he participated in the discussion of a case and presented one of his own, of a

ventral hernia with peritonitis (124). When he graduated on March 27, 1896, he won the prize of $50, presented by Professor Adami for original pathologic research (112).

After graduation, Higgins spent some postdoctoral time at McGill studying bacteriology under Wyatt Johnston and pathology under George Adami. He then returned to the United States and was in veterinary practice in Massachusetts for two years.

His eulogist wrote (122):

> "By 1899, the veterinary pathological work carried on by McGill for the Department of Agriculture had assumed considerable proportions. Dr. Adami had to have more staff and consequently induced Higgins to accept an assistantship with him. In this capacity he carried on work at the Outremont Station, which was the first veterinary laboratory in Canada. This had been established by McEachran for the Dominion Department of Agriculture. Here Higgins isolated strains of tubercle bacilli and produced the first tuberculin in Canada."

Higgins was concurrently appointed assistant to the professor of pathology in the Faculty of Comparative Medicine and Veterinary Science at McGill (125). He did some high-class work on fowl cholera during this appointment (126).

In 1902, J.G. Rutherford was appointed chief veterinary inspector of Canada, and he decided to move the animal pathology work from Montreal to Ottawa. Dr. Higgins was appointed "Pathologist to the Department of Agriculture" and moved into a temporary laboratory on Queen Street. Later that year, a special building was constructed on the experimental farm and served as headquarters for the pathology work for the next 20 years. This was the first full-time post for a veterinary pathologist in Canada. Its establishment was an historical milestone, for it marked the turning over of responsibility for animal pathology from a series of physicians (Osler, Johnston, Adami and Martin) to a veterinarian. (106)

In 1903, Higgins identified the first cases of actinobacillosis in Canada, i.e. in the same year that Lignieres and Spitz published on the distinction of this disease from actinomycosis (127). Higgins was obviously alert in keeping up with the scientific literature of his day, and able to apply it immediately to Canadian animal disease problems (128).

The Dominion Department of Agriculture was conducting feeding experiments in Nova Scotia, in an attempt to discover the cause of Pictou Disease of cattle. Wyatt Johnston had already described the histologic appearance of the characteristic lesion in the spontaneous disease, hepatic cirrhosis (96). Higgins supplied the vital laboratory support for the research in Nova Scotia; he conducted histologic examination to determine whether or not cirrhosis was present in the livers of the experimental cattle (129).

Much of the early activity in the Ottawa laboratory was the manufacture of diagnostic and prophylactic biological products, e.g. tuberculin, mallein and vaccines for blackleg and anthrax. Some was diagnostic work, and from specimens submitted for this purpose Higgins commenced a fine pathologic museum. Based on his experience in diagnostic work, Higgins gave a paper on the postmortem and laboratory diagnosis of anthrax and blackleg at the AVMA meeting in 1903 (130). In the discussion, he engaged in a spirited debate with Veranus Moore of Cornell, condemning the latter's suggestion that specimens submitted for anthrax diagnosis should be wrapped in wet rags for shipment.

It became apparent a year or so after the Ottawa laboratory was founded that more help was needed. Dr. Rutherford hired Drs. Hadwen and Watson, but after a brief period in Ottawa, he sent them to head small regional laboratories in Alberta and British Columbia. Not only were they no help to Higgins, but also Rutherford had them report directly to himself rather than to Higgins. His anonymous eulogist, who I presume is Charles Mitchell, wrote: "As a result, the full force of a consolidated laboratory service had to wait for years." (122). One feels that McEachran would have known better. Rutherford showed good strategic sense in setting up a central laboratory for pathology and bacteriology, but tactically, very little sense of knowing what to do with it once he had it. Perhaps a more charitable view is, as Laidlaw explains, that Rutherford's plan of action was to make haste slowly (131).

In 1909, there was an outbreak of rabies in Canada, and Higgins' laboratory did some of the microscopic examination of the brains of suspect animals, and also rabbit inoculations (132). Higgins also did the laboratory work on an outbreak of suspected actinomycosis in cattle in Saskatchewan, and was able to establish that it was not that disease. In conjunction with a botanist, he was able to identify the condition as pharyngeal trauma caused by the ingestion of "wiregrass," a variety of rush known as *Juncus balticus*. The swellings which the cattlemen saw were suppurating lymph nodes draining the pharyngeal area. Higgins was able to work out the cause of this condition by applying the knowledge of histologic examination he had learned from Adami. Doing so was no mean feat in an era where veterinary pathologists all too often thought that all diseases were due to infection (132).

In his eighth report as pathologist, for the year 1910-1911, Higgins noted that his overworked condition was temporarily alleviated by the hiring of Drs. Wickware and Evans to assist him with pathology and bacteriology, respectively. He reported on how he was training them to do the various diagnostic laboratory procedures, and pointed out that they would not be able to undertake any research work on disease problems important to the livestock industry unless more staff were hired. He had received 423 specimens of diseased tissue during the year, some of which were added to the Department's museum (133).

Rutherford has been described by Smithcors as one of the few great veterinary statesmen in North America (134). However, we learn (from the eulogist, again) that "Higgins had to fight an uphill and, too often, a losing battle to obtain equipment, personnel and adequate laboratory conditions." "... He had visions of organizing an establishment on a much broader scale but even the

most modest addition was considered too expensive." (122). Thus, Higgins had to construct incubators and other laboratory equipment with his own hands. It is hard to accept the designation of anyone so penny-wise and pound-foolish as a statesman. It is not clear to me, however, whether Higgins was obliged to endure this lack of support only under Rutherford's administration or also under Fred Torrance, who succeeded him in 1912. Had either of them been worth his salt, he would have induced the Dominion government to part with the money to pipe gas into Higgins' laboratory.

In 1917, i.e. after five years under Torrance, Higgins (Figure 10) tired of all these struggles and resigned from the Health of Animals Branch. He was appointed head of

Fig. 10. Charles H. Higgins, in 1917. (Courtesy of Dr. R.G. Thomson).

the newly established Canadian branch of the Lederle Laboratories Co. As the eulogist puts it, "By this time he had become frustrated by what he deemed lack of support and adequate recognition in official circles." Strangely enough, there is no mention of Higgins' resignation in Torrance's annual report as Veterinary Director General. In a report otherwise full of trivia, this crippling loss is passed over as if it did not matter (135).

In 1919, Higgins moved to the New York headquarters of the Lederle firm. Unfortunately, his work for them was outside the realm of pathology, and regrettably, a promising individual was lost not only to veterinary pathology but also to veterinary medicine as a whole.

While working as Dominion Animal Pathologist, Higgins was very active in AVMA affairs. Not only did he attend the annual meetings and give papers, but also he was entrusted with the chairmanship of important committees and compiled valuable reports in this capacity (136-138). He became a prominent figure in North American veterinary medicine (139). All of this ceased when he left Canada.

Viewed historically, I think Higgins' greatest contribution was in providing a pathologic basis which enabled the government to establish which diseases were prevalent in Canada, and to sort them out from one another. His second contribution was the establishment of the museum of animal pathology in the Department of Agriculture in Ottawa, a valuable teaching aid for the Meat Inspection Branch, and one from which educational exhibits were mounted at agricultural and veterinary conventions. His third contribution was in training some of the scientific staff of the Division of Pathology, which he was well equipped to do. If he did not do much original research, it was through failure of two Veterinary Director Generals to give him support, moral and financial; worse, failure to support the very idea of research. Thus, Canada lost an expatriate American to the United States in what might be termed a "reverse brain-drain" — an American leaving because the milieu north of the border was inhospitable to a life of the intellect. In his last paper dealing with pathology, one on tuberculosis, Higgins gave as one of his goals in presenting his work at the A.V.M.A. meeting, "...to stimulate greater care in the performance of autopsies..." (140). The McGill stamp — in his case the training under Adami — had impressed itself deeply upon him.

Sometime during his sojourn in Canada, Higgins was commissioned in the Canadian Army Veterinary Corps. He appears in the Militia List of the Dominion of Canada, 1925, as a major with date of rank of September 21, 1916, and date of transfer to the Reserve of Officers of January 15, 1921 (141). I have found no other information on his military service.

Higgins died in New York on November 22, 1954 (142).

W. Reid Blair

William Reid Blair was born in Philadelphia on January 17, 1875, educated in that city, and after the age of ten in Massachusetts (143-145). He entered McGill University in 1899 and graduated as a veterinarian in 1902 (146). Shortly thereafter he became pathologist to the recently established New York Zoological Park, the first American zoo to employ one on a full time basis. By the following year, Blair was publishing the results of his autopsies at the zoo, antedating similar publications from the National Zoo in Washington and the Philadelphia Zoo by several years (147,148).

In conjunction with a part-time colleague, Dr. H. Brooks, Blair published a classical paper entitled "Osteomalacia of Primates in Captivity" in 1905. This identified the osseous lesion and correlated it with the clinical signs, in an enigmatic disease long known as "cage paralysis" which afflicted wild primates after a period of captivity in many zoos (149).

Concurrent with his major job at the zoo, Blair also served between 1905 and 1917 as professor of comparative pathology in the veterinary department of New York

University, providing education to the undergraduates in this subject (143). In 1906, Blair mounted a large exhibit of pathologic tissue specimens at the 43rd annual meeting of the A.V.M.A. in New Haven, Connecticut (150).

Blair published a considerable number of reports on diseases of the captive animals until World War I (151-156). These dealt with the pathological effects of captivity on wild animals, with the pathology of parasitism, and with that of tuberculosis and other infectious diseases. In 1913, Blair was appointed to the editorial board of the American Veterinary Review. This activity as well as his autopsy work and teaching ended when he volunteered for service in 1917, and was commissioned as a major (Figure 11).

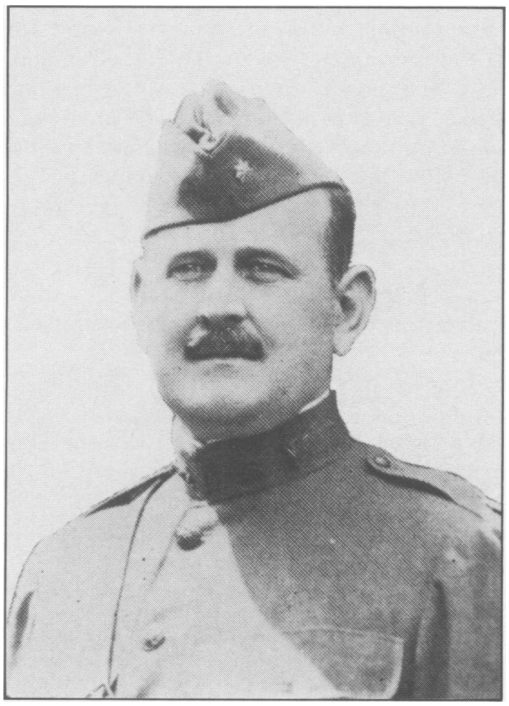


Fig. 11. W. Reid Blair, in 1918. (From Merillat and Campbell) (157).

Blair had a distinguished military career as corps veterinarian for the U.S. IVth Army Corps in France (157). Following demobilization in 1919, he remained in the Veterinary Corps Reserve, reached the rank of colonel in 1923 and retired in 1928 (158). The administrative talents he had shown as commander of a large field hospital were recognized when he returned to the zoo, and he was appointed as Assistant Director of it in 1922. He assumed duties of a clinical nature after his return. With his promotion to Director in 1926, he was lost to pathology.

He made many valuable contributions to the New York Zoological Park. Some were in the realm of preventing the extinction of rare animal species, others in providing outdoor, natural settings rather than cages for the exhibit of animals (144). He published a book covering a quarter century of his medical and surgical experiences with captive wild animals (159). When he joined the zoo in 1902 it had 205 specimens, representing 106 species of animals (160). When he retired in 1940, he had built what the New York Times termed the "most varied zoological collection in the world," comprised of 2600 specimens representing 1000 species. His alma mater, McGill University, recognized his achievements by the award of an honorary LL.D. degree in 1928 (161).

As luck would have it, both Blair and his fellow McGill alumnus Higgins were essentially lost to veterinary pathology in the same year, 1917. But each left behind him functioning pathology laboratories, which even if they were not continued on the same plane by others, exemplified what could be done by talented men provided with fine professional education and imbued with high aspirations. During the first two decades of this century, Blair and Higgins were recognized leaders in North American veterinary medicine as well as in veterinary pathology (162). Again, Duncan McEachran had done his work superbly in Montreal, in selecting his students as well as his teachers!

Blair died in New York on March 1, 1949.

W.L. Williams

The numerous biographical writings on Osler indicate that he left deep and lasting impressions on his students. Few were deeper, and none could have been more lasting than the one he made on Walter L. Williams, born in 1856 in Argenta, Illinois.

A member of the original faculty which founded the New York State Veterinary College at Cornell University in 1895, Williams was educated at the Illinois Technical University (later known as the University of Illinois) (163). He attended the Montreal Veterinary College from 1878 until 1879, where he was taught pathology and physiology by William Osler. He won the silver medal awarded by the province of Quebec to the leading student in the class (20).

After graduation Williams was in practice in Illinois and in 1887 was the first to recognize the disease dourine in the United States (164). In 1891 his health broke down, and he joined the faculty first of Purdue University and later of Montana State College. A careful investigator and a prolific writer, he published on pathology while still a large animal practitioner (165-168). In Montana, he issued a bulletin in which the gross lesions of glanders were clearly and expertly illustrated (169). His publications, before he joined Cornell University, are too numerous to list here, but one of them requires attention because it reveals Williams' Oslerian heritage (170).

In 1887 Williams had published a paper on invasion of the mesenteric arteries by nematodes in the horse (168). In 1895, in a paper on the therapeutics of colic in the horse, he demonstrated at once his ability to learn from experience, his knowledge of the German literature, and the lesson learned from Osler that if one understood the pathology of a disease one would be disinclined to overtreat it (170).

Williams reflected on the poor results he had obtained from treating equine colic by medication, and on a body of German literature which indicated that a greater percentage of cases recovered without treatment than with it. He wrote that early in his practice, when he medicated such cases:

> "... my losses from colic were appalling, costing me many anxious hours and valued patrons, but as necessity and reason drove me further from what I thought classic methods, and taught me a higher appreciation of nature's powers and her abhorrence of unnecessary meddling in disease, my losses became much less."

Pointing out that among the causes of colic was interruption of the gastro-intestinal blood supply by thrombi, he stated:

> "The application of rational therapeutics to this group of pathological conditions renders it necessary that our first law shall be to rigidly avoid the use of any medical agency which would tend to aggravate any pathological conditions present, whether recognizable or not; or to pursue, as far as possible, an expectant line of treatment."

In Williams' words, one can clearly discern the Oslerian approach to diagnosis and treatment; in fact, one can easily imagine Osler — equally familiar with the German literature on verminous mesenteric arteritis in horses — speaking or writing the same words.

At Cornell, Williams (Figure 12) was professor of surgery and later of obstetrics, breeding diseases and ethics. His textbooks on the first three of these subjects remained the standard ones for 50 years and were translated into foreign languages (171-173).

Fig. 12. Walter L. Williams, in 1896. (Courtesy of Dr. E.P. Leonard, Cornell University).

Williams was an inspired teacher, gifted with keen intellect, lifelong curiosity, enthusiasm for his subject, the highest scientific and ethical ideals, and a superlative command of his written and spoken language. Williams' books, papers (174-180), lectures and demonstrations at meetings on breeding diseases at veterinary conventions moved him into a position of undisputed leadership in this field, which he held for decades. No American or Canadian veterinary school in the first quarter of the 20th century had any clinical teacher remotely approaching his erudition, knowledge of the domestic and foreign literature, pedagogic ability and research productivity.

His distinguished career at Cornell brought him worldwide recognition. To an extent that none of his contemporaries even remotely approached, Williams' clinical work was always based on a solid foundation of pathology. He had acquired this cast of mind from Osler, and it stamped him for life, as it had so many of Osler's students.

Although Williams retired from teaching at Cornell in 1922, he remained active in research and writing for almost a quarter of a century thereafter, during which he could be found on the campus almost every day. In 1944, sixty-five years after he had graduated from the Montreal Veterinary College, Williams gave a lecture on his professional career which spanned this period (181). Here in his own words, is the recollection of his student days under Osler, shining forth undimmed more than half a century later.

> "The physiology-pathology was a lecture course by Dr. William Osler. He was the greatest, most inspiring teacher I had known, and since that time I have not consciously met his equal. Then a young man, seven years my senior, he came upon the rostrum at a brisk walk at the minute due, began his lecture without delay, and rapidly and clearly discussed the subject under consideration. As I now recall, he never emphasized what he knew, and never intimated that he knew very much. He placed great emphasis upon the interesting and important things which a student might learn. But it remained for the student to do the learning. He did not resort to the pumping process so profusely used by some professors in an effort to inject knowledge into registrants in his classes. In the opening address to the students in the veterinary college, Dr. Osler defined pathology as the 'physiology and microscopical anatomy of disease.' His lectures, as I understood them, were devoted to the development of this theme and the 'inseparability of physiology and pathology' emphasized. His abundant illustrations were largely the tissues and organs freshly obtained from autopsies in the Montreal General Hospital."

Hearing this, can anyone doubt that Osler left an indelible imprint on Williams? Can you imagine, especially those of you who are teachers, having such an impact on a student that he recalls it in vivid prose 65 years later? Have you ever read admiration for a mentor expressed more eloquently? And lest anyone think that what I have cited here is the product of

some senile musing, here (Figure 13) is a picture of "Uncle Billy", as he was fondly known at Cornell, as active as a cricket in his 88th year! And what is this activity? He is doing what Osler did — a brilliant clinician sitting at the autopsy table and dissecting, a bright sparkle in his eye and an intent and child-like curiosity in his mien. He is also practicing what he has been "preaching" the principle of applying a knowledge of pathology to clinical practice with him from Montreal. In the earlier part of his career at Cornell, Williams concentrated on surgery. Later his interests shifted to obstetrics and reproductive diseases. As one reads his papers and books, some now 95 years old, one repeatedly encounters pathology, both as pathogenesis and as pathologic

Fig. 13. Walter L. Williams, dissecting a pathological specimen at Cornell University in 1944. (Courtesy of Dr. Lennart Krook, Cornell University).

at least since 1888, when he advocated to his fellow veterinary practitioners:

> "The post-mortem study of disease is far more available to us than to the medical practitioner, there being no adverse sentiment in our way; so that we should make a careful post-mortem study of most of our fatal cases, and should allow nothing but the most urgent duties to interfere with our plans." (182).

Like A.W. Clement, who likewise bore the stamp of Osler's teaching all of his professional life, Williams took anatomy in work after work. Whether in surgery or in obstetrics, the basic emphasis on altered function, altered structure, embryology or etiology is ever present, and always in a logical sequence, preceding surgical or medical treatment.

It is there to an extent that one does not expect from a veterinary clinician before the turn of the century, or get from some clinical teachers even in 1984! Moreover, Wiliams' descriptions of genital lesions or surgical conditions in horses and cattle are often better than we can find from some of his contemporaries who professed to

teach pathology, either at Cornell or elsewhere. Better is perhaps the wrong word when comparing the output of a clinician who was doing pathologic investigation with that of pathologists who were not.

It does not diminish Williams' stature in the slightest, to point out that the stimulus of Osler's teaching, the example which showed that a clinician can ask and answer basic questions, can be unmistakably recognized in the pupil. In fact Williams had already acknowledged his professional heritage publicly on an earlier occasion, when he stated at the A.V.M.A. convention in 1940, relative to the founding of the veterinary college at Cornell in 1895: "The clinics initiated by Professor Law and myself... constitute, in a large measure, *an adaptation of Osler's ideals* to the teaching of veterinary medicine." (italics mine) (134). Williams, of course, provided a fruitful soil in which Osler's influence could germinate.

One of Virchow's most ardent admirers, Williams was exposed to Virchow's ideas secondhand; thus he was molded by the thinking of two of the best minds in nineteenth century pathology. He had learned German at the Illinois Technical University before enrolling at Montreal, sufficiently well that he later translated a German book on veterinary surgery into English. Mastery of German gave him access to the work of German veterinary pathologists, whose publications dominated veterinary literature in the nineteenth century. Of course, Williams' accomplishments were chiefly the product of his own curiosity, intellect, energy and drive. But one may still ask, given such a mentor, could Williams have done anything other than succeed brilliantly?

Williams' death in Ithaca on October 23, 1945, in his ninetieth year, marked the end of an academic career unparalleled in North American veterinary medicine. It also marked the demise of the last of Osler's students at the Montreal Veterinary College. Never had McEachran and Osler's judgment been better vindicated than in their selection of the silver medallist from the class of 1879.

The Enduring Osler

Tenuous though it may seem, Osler's influence can be traced to the lives of several contemporary veterinary pathologists, through their mentor, Peter Olafson (1897-1985). The latter had studied at the North Dakota Agricultural College, and sought advice from Dr. A.F. Schalk, a research veterinarian there, as to where he might best go to veterinary school. Schalk advised Olafson to go to Cornell because W.L. Williams was teaching there. When Olafson arrived at Cornell in 1924, Williams was already retired, but (as mentioned earlier) he continued to work for another 25 years and to influence all who came in contact with him. After graduation, Olafson remained at Cornell as a teacher (Figure 14).

Almost sixty years later, in October of 1983, I told Dr. Olafson that in studying Dr. Williams' career, it seemed to me that he had become a renowned clinician because he was not merely treating disease, but had acquired from Osler a mind set to learn the pathology of what he was

Fig. 14. Peter Olafson, in the late 1920's. (Courtesy of Dr. Kenneth McEntee, Cornell University).

treating. Further, I thought that Williams had contributed enough to veterinary pathology to merit inclusion in a biographical history of this discipline which I was writing. He had even had the audacity, as a clinician, to review a German book on veterinary pathology! (183) Olafson replied that Williams indeed merited such historical treatment. He then surprised me by relating that he had chosen to study at Cornell because Williams was there, something he had not mentioned in the 35 years I had known him! [This had been documented by Leonard in 1982 (184), but at the time I spoke with Olafson I had not yet read it.]

As we have seen, Osler's teaching and example helped to shape Williams into the outstanding veterinarian that he became. Although their lives followed different paths, Olafson learned a lot from Williams, who served as a role model of lofty ethical and intellectual standards and a lifelong example of remaining curious, always thinking and always investigating.

Olafson also learned from Williams that clinical medicine and surgery were only one side of the coin of disease; he consequently taught pathology not in isolation, but correlated with the other, clinical side of the coin. By mid-twentieth century Olafson had achieved great distinction as an undergraduate and graduate teacher and as a research worker (185). His famous "show and tell" method of teaching at the autopsy table, rivetted the attention of students. It was a counterpart of Osler's teaching, of which Thomas McCrae had written: "William

Osler was a great morbid anatomist and his 'clinics' in the autopsy room were if anything more interesting than those by the bedside . . . [He] reconstructed the history of events from the specimens." (186).

In my D.L.T. Smith Lecture earlier this year, I said: "Certainly Larry Smith went to Cornell solely because he wanted to work with Olafson; and so the thread remains unbroken, between William Osler and his veterinary students in Montreal and Larry Smith and his veterinary students, first in Guelph and later in Saskatoon." It remains unbroken also between Peter Olafson and his other students: Frank Bloom, Donald Cordy, Leonard Goss, Kenneth Jubb, Peter Kennedy, John King, Kenneth McEntee, William Monlux, and William Sippel to name but a few who have enriched North American veterinary pathology. All are professional descendents, through Walter Williams, of William Osler.

It is a thread of hard work, clear thinking, concern for one's patients or charges rather than for oneself, and a vision of the future—that one can make it better by dedication to the pursuit of excellence in service to the public. William Osler has left us an enduring legacy, in a tradition now exactly one hundred years old — roots of which we veterinary pathologists may all be proud. He was a devout believer in continuing education and constantly proclaimed its virtues. He showed specimens and gave talks at innumerable medical society and veterinary medical society meetings in Montreal and Philadelhia.

His Canadian compatriots have expressed their affection for and pride in Osler in many ways; a few years ago by the issuance of a postage stamp (Figure 15) (187). As we look at it, it is easy to imagine that Sir William, the inspired teacher, has returned to Toronto and is here with us in spirit today. If so, he would surely be pleased at how the discipline of pathology which he introduced in our North American veterinary schools is flourishing on the continent which gave him birth. And he would surely find it heartening to view the unrivalled annual participation in continuing education by our North American veterinary pathologists, in keeping with one of his most cherished goals.

In introducing the spirit of William Osler to a group of his professional descendants, gathered near his birthplace for the purpose of continuing their education, I can think of no more apt citation from his writings than this:

> "This higher education so much needed today is not given in the school, is not to be bought in the market place, but it has to be wrought out in each one of us for himself; it is the silent influence of character on character and in no way more potently than in the contemplation of the lives of the great and good of the past, in no way more than in 'the touch divine of noble natures gone' (188)."

Ladies and gentlemen, mesdames et messieurs, I have heeded Sir William's advice, and have indulged in the contemplation he advocated, of "the lives of the great and good of the past." The result of this contemplation, which you have graciously allowed me to share with you today, is that if veterinary pathology in North America is thriving in 1984, it is in no small measure due to the man who had given it such a fine start by 1884.

Thank you very much, my friends. Merci beaucoup, mes amis.

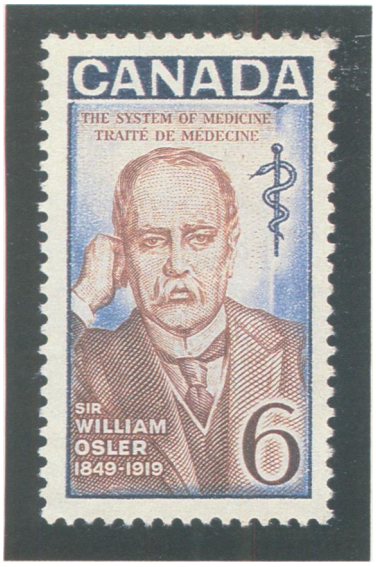


Fig. 15. Postage stamp portraying Sir William Osler, issued by the Canada Post Office in 1969, on the 50th anniversary of his death. (By permission of Canada Post Corporation).

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Fig. 16. Coat of arms of the Montreal Veterinary College, from the McGill University catalog of 1901.

REFERENCES

1. **SAUNDERS LZ, BARRON CN.** A century of veterinary pathology at the AFIP, 1870-1970. Path Vet 1970; 7: 193-224.
2. **JONES, TC, SAUNDERS LZ.** A tribute to Colonel James Earle Ash, MC U.S.A. (Retired) on the occasion of his 100th birthday September 8, 1984. Vet Path 1984, 21: 367-369.
3. **CUSHING H.** The life of Sir William Osler. Vols 1 & 2. Oxford: Clarendon Press, 1925. (Unsatisfactory single volume edition, on cheap paper, with 36 of the original 47 illustrations omitted, New York: Oxford University Press, 1940).
4. **GATTINGER FE.** A century of challenge. Toronto: University of Toronto Press, 1962: 25-32.
5. **MILLS TW.** The Montreal Veterinary College and its founder and principal. J Comp Med Vet Arch 1888; 9: 74-84.
6. **MITCHELL CA.** Duncan McEachran. Can J Comp Med 1939; *3*: 255-258.
7. **VOKATY S.** The adventures of Dr. Duncan McNab McEachran in Western Canada. Can Vet J 1979; 20: 149-156.
8. **TODD JL, WOLBACH SB.** The swamp fever of horses. Rep Vet Dir Gen for yr ending Mar 1911. Ottawa, 1911; 157-177.
9. **HOUCK UG.** The Bureau of Animal Industry of the US Department of Agriculture. Washington: Published by the Author, 1924: 59-60.
10. **CHRISTIANSEN GC.** Veterinary medical education, a rapid revolution. In: Smithcors, JF. The American veterinary profession. Ames: Iowa State University Press, 1963: 641-665.
11. **ANONYMOUS.** Veterinary colleges of North America. Amer Vet Rev 1895; 18: 432-435.
12. **FRENCH C.** Intestinal parasitism in the dog. J Comp Med Vet Arch 1896; 17: 441-452.
13. **GILL HD.** Defective development of the central nervous system in a cat. J Comp Med Vet Arch 1895; 17: 393-394.
14. **HUDDLESTON JH.** Tumors from the choroid plexus of a horse. Proc Path Soc NY 1895; 29-30.
15. **SAUNDERS LZ.** Veterinary pathology in Russia 1860-1930. Ithaca: Cornell University Press, 1980.
16. **MERILLAT LA, CAMPBELL DM.** Veterinary military history of the United States. Kansas City, Mo: Haver-Glover Laboratories, 1935: 238.
17. **KNOPF SA.** Dr. John Henry Huddleston. In memoriam. Med Rec 1915; 88: 839-840.
18. **SMITH DK.** Practical hints in pathology. J Comp Med Vet Arch 1902; 23: 228-230.
19. **SMITH DK.** Malignant tumors. Proc 40th Ann Mtg A.V.M.A. 1903; 314-315.
20. **LEONARD EP.** A Cornell heritage: veterinary medicine 1868-1908. Ithaca, N.Y. State Coll. Vet. Med., 1979; 194-195.
21. **STANGE CH.** History of veterinary medicine at Iowa State College. Ames: Iowa, Iowa State College, 1929: 15-17.
22. **SATTERTHWAITE TE.** Some of the recent contributions to the literature of comparative medicine. J Comp Med Surg 1880; 1: 185-192.
23. **SATTERTHWAITE TE.** The study of comparative pathology: Introductory lecture of a course, delivered at the Columbia Veterinary College in 1881-1882. J Comp Med Surg 1882; 3: 1-13.
24. **SCHRADY J.** ed. The College of Physicians and Surgeons in New York, Vol 1: New York, 1903, 550-554.
25. **LONG ES.** A history of American pathology. Springfield: Charles C Thomas, 1960: 178, 229-230.
26. **NIELSEN NO.** Schofield lecture 1982. Comparative medicine. Can Vet J 1983; 24: 269-277.
27. **McEACHERN D.** Osler and the Montreal Veterinary College. Can Med Assoc J 1920; 20: (Osler Memorial Number) 35-37.
28. **MURPHY DA.** Osler, now a veterinarian. Can Med Assoc J 1960; 83: 32-35.
29. **McEACHRAN D.** "Be gentlemen." Am Vet Rev 1890; 14: 109-114.
30. **McEACHRAN D.** Contagious pleuro-pneumonia. p. 222. In: Annual report on the cattle quarantines. In: Canada, Dept. of Agr., Chief Veterinary Inspector. Ottawa, 1886: 195-235.
31. **ANONYMOUS.** Montreal Veterinary College. Vet J 1881; 13: 455-456.
32. **MITCHELL CA.** A note on the early history of veterinary science in Canada. Can J Comp Med 1939; 3: 276-281.
33. **EBY CH.** Sir William Osler and veterinary medicine — a biographical sketch. J Small Anim Pract 1960; 1: 273-276.
34. **ROLAND CG.** The palpable Osler: A study in survival. Persp Biol Med 1984; 27: 299-313.
35. **CAMERON TWM.** Sir William Osler and parasitology. J Parasit 1950; 36: 93-102.
36. **TALBOTT JH.** A biographical history of medicine. New York: Grune & Stratton, 1970: 1138-1141.
37. **BARKER CAV.** The Ontario Veterinary College: Temperance Street era. Can Vet J 1975; 16: 319-328.
38. **WARE J, HUNT H.** The several lives of a victorian vet. London: Bachman & Turner, 1979: 99.
39. **OSLER W.** Berlin correspondence. Can Med Surg J 1873-1874; 2: 231-233; 308-315.
40. **OSLER W.** Allgemeines Krankenhaus. Can Med Surg J 1873-1874; 2: 451-456.
41. **OSLER W.** Rudolf Virchow, the man and the student. Boston Med Surg J 1891; 125: 425-427.
42. **OPIE EL.** Osler as a pathologist. Bull Hist Med 1949; 23: 321-324.
43. **BEAN WB.** Foreword (pp. xiii-xv) In: Rodin AE. Oslerian pathology. An assessment and annotated atlas of museum specimens. Lawrence, Kansas: Coronado Press, 1981; 194-195.
44. **ANONYMOUS.** Society proceedings. Medico-Chirurgical Society of Montreal. Pneumo-enteritis of the hog. Can Med Surg J 1884; 12: 429.
45. **ANONYMOUS.** Society proceedings. Medico-Chirurgical Society of Montreal. Portions of muscle, intestine and kidney from horse dying of toxic haemoglobinuria or azoturia. Can Med Surg J 1884; 12: 545-546.
46. **ANONYMOUS.** Society proceedings. Medico-Chirurgical Society of Montreal. Actinomykosis (cow). Can Med Surg J 1884; 12: 599.
47. **ANONYMOUS.** Montreal Veterinary College. Vet J 1876; 3: 465-466.
48. **ANONYMOUS.** Opening of the Montreal Veterinary College. Vet. J. 1878; 7: 405-408.
49. **OSLER W.** The master-word in medicine. Brit Med J 1903; ii: 1196-1200.
50. **OSLER W.** Verminous bronchitis in dogs. The Veterinarian 1877; 50: 387-397.
51. **OSLER W.** On the pathology of so-called pig typhoid. Vet J Ann Comp Path 1878; 6: 385-402.
52. **SAUNDERS LZ.** Schofield memorial lecture. Some pioneers in comparative medicine. Can Vet J 1973; 14: 27-35.
53. **OSLER W.** On echinococcus disease in America. Am J Med Sci 1882; 84: 475-480.
54. **OSLER W, CLEMENT AW.** Parasites in the pork supply of Montreal. Can Med Surg J 1883; 11: 325-326.

55. **OSLER W, CLEMENT AW.** Diffuse purulent bronchiestasy in a calf, with morbid anatomy notes. J Comp Med Surg 1882; 3: 317-319.
56. **OSLER W, CLEMENT AW.** Chronic bronchitis — spurious melanosis of lungs in a dog. J Comp Med Surg 1882; 3: 319-320.
57. **OSLER W, CLEMENT AW.** Haemato-pyo-metra in a bitch. J Comp Med Surg 1882; 3: 320-321.
58. **OSLER W, CLEMENT AW.** Cestode tuberculosis. A successful experiment in producing it in the calf. Am Vet Rev 1882; 6: 6-10.
59. **OSLER W.** Report on Pictou Cattle Disease investigations. Rep. Min. Agr. Dominion of Canada for 1882, Ottawa, Queen's Printer, 1883; 289-293. (Reprinted in: The Veterinarian 1883 56: 478-485).
60. **ANONYMOUS.** Montreal Veterinary Medical Association. Vet J 1880; 11: 431-432.
61. **ANONYMOUS.** Montreal Veterinary Association. Vet J 1877; 5: 457.
62. **ANONYMOUS.** Montreal Veterinary Medical Association. Vet J 1878; 6: 62-63.
63. **TEIGEN PM.** William Osler and comparative medicine. Can Vet J 1984; 25: 400-405.
64. **ANONYMOUS.** Necrology. Albert W. Clement. J Comp Med Vet Arch 1901; 22: 178-180.
65. **MARTENET WH.** Obituary. Albert W. Clement, D.V.S. Am Vet Rev 1901; 25: 65-66.
66. **RODIN AE.** Oslerian pathology. An assessment and annotated atlas of museum specimens. Lawrence, Kansas: Coronado Press, 1981: 194-195.
67. **OSLER W, CLEMENT AW.** Lungs of a horse which had died of pneumonia. Can Med Surg J 1883; 11: 498.
68. **ANONYMOUS.** Montreal Veterinary College. Vet J 1884; 18: 460-461.
69. **CLEMENT AW.** Acute parenchymatous nephritis. J Comp Med Surg 1885; 6: 308-315.
70. **JONES TC, HUNT RD.** Veterinary pathology. 5th ed. Philadelphia: Lea & Febiger, 1983: 1145-1148.
71. **CLEMENT AW.** A few notes on some of the principal centers of veterinary education in England and on the Continent. J Comp Med Surg 1887; 8: 144-149.
72. **SAUNDERS LZ.** Albert W. Clement, the first president of the A.V.M.A. (In preparation) 1987.
73. **CLEMENT AW.** Veterinary post-mortem examinations. In: Buck AH. ed. Reference handbook of the medical sciences. Vol 7. New York: William Wood, 1889: 641-653. (Also published as separate book with the same title. New York: Sabiston & Murray, 1891).
74. **CONKLIN WA.** Review of CLEMENT AW. Veterinary Post-Mortem Examinations. J Comp Med Vet Arch 1891; 12: 409.
75. **CLEMENT AW.** Discussion on hog cholera. Proc U.S.V.M.A. 28 Ann Meet 1891. Philadelphia; 1893; 154.
76. **CLEMENT AW.** Case reports: Rupture of mesenteric artery; Hemorrhage at the base of the brain; Rupture of the coronary artery. J Comp Med Surg 1886; 7: 186-188.
77. **WELCH WH.** Preliminary report of investigations concerning the causation of hog cholera. Bull Johns Hopkins Hosp 1889; 1: 9-10.
78. **WELCH WH, CLEMENT AW.** Remarks on hog cholera and swine plague. Proc 30th Ann Meet, U S Vet Med Assoc. Oct. 16-20, Chicago, 1893; 206-214. Philadelphia, U S Vet Med Assoc (Reprinted In: Vol 1, 86-96 In: WELCH, WH. Papers and addresses. Baltimore: Johns Hopkins Press, 1932 also Historiae Med Vet 1980; 5: 1-37.).
79. **CLEMENT AW.** Description of some specimens of pleuro-pneumonia contagiosa. J Comp Med Surg 1888; 9: 151-155.
80. **CLEMENT AW.** "So-called" spinal meningitis. J Comp Med Vet Arch 1892; 13: 486-488.
81. **CLEMENT AW.** Record of a case of glanders in man with history of infection from a horse, together with a clinical and post-mortem record of the case in the suspected animal. J Comp Med Vet Arch 1893; 14: 65-69.
82. **CLEMENT AW.** Dislocation between the second and third cervical vertebrae in a horse. J Comp Med Vet Arch 1894; 15: 455-456.
83. **CLEMENT AW.** Some of the more prevalent diseases affecting animals. J Comp Med Vet Arch 1898; 19: 6-12.
84. **CLEMENT AW, STOKES WR.** Rabies in sheep. J Comp Med Vet Arch 1897; 18: 271-274.
85. **STOKES WR, CLEMENT AW.** An epidemic of purulent inflammation of the milk ducts, affecting seventy cows. J Comp Med Vet Arch 1897; 18: 135-138.
86. **CLEMENT AW.** Review of Jahresbericht der K. Central-Thierarznei-Schule in München 1886. J Comp Med Surg 1888; 9: 205-206.
87. **CLEMENT AW.** President's address. Proc. 36th Ann Meet Am Vet Med Assoc 1899; 1-8.
88. **MacCALLUM WG, CLEMENT AW.** Pulmonary tuberculosis with diffuse pneumonic consolidation in a lion. Bull Johns Hopkins Hosp 1900; 2: 85-86.
89. **CLEMENT AW.** State examinations. Proc. Am Vet Med Assoc 36th Ann Meet 1899; 270-274.
90. **CLEMENT AW.** The inspection of meat and milk with special reference to tuberculosis. Am Vet Rev 1890; 14: 76-86, 114-124.
91. **ANONYMOUS.** McGill University. J Comp Med Vet Arch 1896; 17: 428-429.
92. **ABBOT M.** History of medicine in the province of Quebec. Montreal: McGill University, 1931; 87.
93. **ANONYMOUS.** Obituary. Professor Wyatt Galt Johnston. Montreal Med J 1902; 31: 554-560.
94. **ADAMI JG.** On the teaching of pathology. Phila Med J 1900; 6: 399-402.
95. **JOHNSTON W.** Preliminary report on the pathology of the Pictou cattle disease. Rep Min Agr Dominion of Canada, for 1892; 41-47. Ottawa, Queen's Printer 1893.
96. **JOHNSTON W.** Biliary cirrhosis of the liver in cattle (Pictou cattle disease). Proc 30th Ann. Conv. U S Vet Med Assoc Chicago 1893; 120-126. Philadelphia U S Vet Med Assoc 1894.
97. **ANONYMOUS.** Montreal Veterinary Medical Association. Am Vet Rev 1891; 15: 56-57.
98. **ANONYMOUS.** Montreal Veterinary College. J Comp Med Surg 1888; 9: 327-238.
99. **JOHNSTON W.** Local tuberculous abscess in a bull. Proc. 29th Ann. Meet. U S Vet Med Assoc, Boston 1892; 347-350. Philadelphia, U S Vet Med Assoc 1893.
100. **ABBOT M.** The Wyatt Johnston descriptive classification of museum specimens, as applied in the pathology museum of McGill University. Bull Int Assn Med Museums 1925; 11: 78-89.
101. **DOUGLAS AJ.** et al. Wyatt Galt Johnston. Am J Publ Health 1931; 21: 1243-1245.
102. **OSLER W.** Obituary. Dr. Wyatt Johnston. Med. News (N.Y.) 1902; 80: 1233.
103. **ADAMI JG.** J. George Adami, A memoir. London: Constable, 1930.
104. **ADAMI JG.** Principles of pathology. Philadelphia: Lea & Febiger, Vol. 1, 1908, Vol. 2, 1909.
105. **ADAMI JG.** Pictou cattle disease. Montreal Med J 1902; 31: 105-117.
106. **ADAMI JG, MARTIN CF.** Report on observations made upon the cattle at the experimental station at Outremont, recognized to be tuberculous by the tuberculin test. Ottawa, 1899.
107. **ADAMI JG.** On the significance of bovine tuberculosis and its eradication in Canada. Can J Med Surg 1899; 6: 391-405.
108. **ADAMI JG.** On the relationship between human and bovine tuberculosis. Phila Med J 1902; 9: 356-365.
109. **ADAMI JG.** Secondary enchondroma in a bitch. Can Med Rec 1895; 23: 105.
110. **ADAMI JG.** Certain points in connection with the development of our knowledge of actinomycosis and its causation. Montreal Med J 1905; 34: 88-93.
111. **ADAMI JG.** On a giant-celled rhabdomyosarcoma from the trout. Montreal Med J 1908; 37: 163-165.
112. **ANONYMOUS.** Commencement exercises at the veterinary department, McGill University. Vet Mag 1896; 3: 390-391.
113. **ADAMI JG.** "On this side Jordan": Inaugural lecture in the faculty of comparative medicine, McGill University, October 1894. Montreal Med 1895; 23: 256-270.
114. **McGREGOR J.** Montreal Veterinary Medical Association. J Comp Vet Med Arch 1898; 19: 832-834.

115. **LEHNERT EH.** Montreal Veterinary Medical Assn. Vet Mag 1895; 2: 63-65.
116. **DELL, HH.** Montreal Veterinary Medical Assn. Vet Mag 1895; 2: 648-649.
117. **ADAMI JG, BELL J, ROBBINS GD.** Chronic human glanders. Montreal Med J 1905; 34: 538-540.
118. **ADAMI JG.** On tuberculosis in relation to the live-stock industry. Boston Med Surg J 1902; 146: 619-624.
119. **ANONYMOUS.** Pleuro-pneumonia. The subject of an interesting discussion by the Montreal Veterinary Medical Assn. Vet Mag 1894; 1: 71-72.
120. **McFADYEAN J.** The discussion on pleuro-pneumonia at the Montreal meeting of the British Medical Assn. J Comp Path Therap 1897; 10: 349-350.
121. **PATTISON I.** The British veterinary profession 1791-1948. London: J A Allen, 1893: 156-157.
122. **ANONYMOUS.** Obituary. Charles H. Higgins. Can J Comp Med 1955; 19: 2-5. (Author is probably CA. Mitchell).
123. **DELL, H.** Montreal Veterinary Medical Assn. Vet Mag 1896; 3: 128, 202-203.
124. **DELL, H.** Montreal Veterinary Medical Assn. Vet Mag 1896; 3: 256.
125. **ANONYMOUS.** Veterinary department of McGill University. J Comp Med Vet Arch 1901; 22: 256-258.
126. **HIGGINS CH.** Notes upon an epidemic of fowl cholera. J Exp Med 1898; 3: 651-671.
127. **HIGGINS CH.** Actinobacillosis. In: Rpt Vet Dir Gen Dominion of Canada for 1904. Ottawa 1905; 146-151.
128. **HIGGINS CH.** Actinobacillosis. In: Proc 41st Ann Meet Am Vet Med Assoc 1904; 131-134.
129. **RUTHERFORD JG.** Special report on Pictou cattle disease: Part 1. (Reprinted from Rep. Vet. Dir. Gen. 1906.) In Can. Vet J. 1982; 23: 361-364.
130. **HIGGINS CH.** Anthrax and blackleg. In: Proc 40th Ann Meet Am Vet Med Assoc 1903; 292-300.
131. **LAIDLAW C.** Dr. J.G. Rutherford and bovine tuberculosis. Bull Can Tuberc Assoc (suppl.) 1930; 1-4.
132. **HIGGINS CH.** Report of pathologist. In: Rep Vet Dir Gen for 1910. Ottawa, 1911; 40-42; 53-57.
133. **HIGGINS CH.** Report of pathologist. In: Rep Vet Dir Gen Dominion of Canada 1911. Ottawa, 1912; 123-127.
134. **SMITHCORS F.** The American veterinary profession. Ames: Iowa State University Press, 1963; 606.
135. **TORRANCE F.** Pathological division. In: Rep Vet Dir Gen Dominion of Canada for yr ending Mar 1819. Ottawa 1919; 15-17, 39.
136. **HIGGINS CH.** Canadian chicken cholera. In: Proc 36th Ann Meet Am Vet Med Assoc, Ithaca, 1899; 227-233.
137. **HIGGINS CH.** Laboratory aids. In: Proc 43rd Ann Meet Am Vet Med Assoc 1906; 138-144.
138. **HIGGINS CH.** Discussion of methods of mounting museum specimens. In: Proc 50th Ann Meet Am Vet Med Assoc, 1913. Philadelphia, 1914; 759.
139. **HIGGINS CH.** Human and comparative medicine. Am Vet Rev 1905; 29: 450-457.
140. **HIGGINS CH.** Channels of infection and localization in tuberculosis. J Am Vet Med Assoc 1917; 52: 299-308.
141. **CANADA.** Department of National Defence. The Militia List. Part II. 1925; 130.
142. **ANONYMOUS.** Death of Dr. Charles H. Higgins. J Am Vet Med Assoc 1955; 126: 254.
143. **ANONYMOUS.** W. Reid Blair, D.V.Sc., 1875-1949. J Am Vet Med Assoc 1949; 114: 345.
144. **ANONYMOUS.** Dr. W. Reid Bair, Zoo Head 14 Years. Obituary, N.Y. Times March 2, 1949; 25.
145. **CRANDALL LS.** W. Reid Blair, in Memoriam. Animal Kingdom April, 1949; 52(2): 59-60.
146. **ANONYMOUS.** McGill University. J Comp Med Vet Arch 1902; 23: 316-317.
147. **BLAIR WR.** Cysticerci in wild ruminants. Am Vet Rev 1903; 27: 386-395.
148. **BLAIR WR.** Autopsy summaries of wild animals. Am Vet Rev 1903; 27: 526-529.
149. **BROOKS H, BLAIR WR.** Osteomalacia of primates in captivity. A clinical and pathological study of "cage paralysis." Rep N Y Zool Soc 1904; 9: 135-175.
150. **BLAIR WR.** Pathological exhibit. Proc. 43rd Ann Meet Am Vet Med Assoc. New Haven: 1906: 391.
151. **BLAIR WR.** Filariae. Am Vet Rev 1905; 28: 1147-1153.
152. **BLAIR WR.** Five Lambs at one parturition. Am Vet Rev 1906; 30: 224.
153. **BLAIR WR.** Correspondence. Am Vet Rev 1906; 30: 603-604.
154. **BLAIR WR.** Osteomyelitis in a dog. Am Vet Rev 1906; 30: 696-698.
155. **BLAIR WR.** Modes of tubercular infection in wild animals in captivity. Am Vet Rev 1906; 30: 1299-1306.
156. **BLAIR WR.** The pathological effects of captivity on wild animals. Proc. 45th Ann Meet Am Vet Med Assoc, New Haven: 1906: 391.
157. **MERILLAT LA, CAMPBELL DM.** Veterinary military history of the United States. Vol. 2, Kansas City, Mo: Haver-Glover Laboratories, 1935: 737.
158. **ANONYMOUS.** Army veterinary service. Changes relative to veterinary officers. Reserve Corps. North Am Vet. 1928; 9(12): 72.
159. **BLAIR WR.** In the zoo. New York: Scribner, 1931.
160. **BLAIR WR.** The New York zoological park. J Am Vet Med Assoc 1938; 92: 752-759.
161. **MILLER FH.** Academic honors for Wm. Reid Blair. North Am Vet 1928; 9(8): 70.
162. **BLAIR WR.** Veterinary medical society of New York county. Am Vet Rev 1906; 30: 1478-1480.
163. **FROST JN.** Walter L. Williams. Cornell Vet 1946; 36: 100-103.
164. **WILLIAMS WL.** Horse syphylis or maladie du coit (dourine). Am Vet Rev 1888-1889; 12: 295-303; 341-349; 402-410; 445-450.
165. **WILLIAMS WL.** A clinical study of odontomes. Am Vet Rev 1891; 15: 1-17; 64-74.
166. **WILLIAMS WL.** Contagious pleuro-pneumonia of the horse. Am Vet Rev 1892; 16: 301-317.
167. **WILLIAMS WL.** The pathology of azoturia. Am Vet Rev 1890; 14: 172-181.
168. **WILLIAMS WL.** Invasion of the mesenteric arteries of the horse by Strongylus armatus. Vet J Ann Comp Path 1887; 24: 159-164, 234-240.
169. **WILLIAMS WL.** Glanders. Am Vet Rev 1895; 18: 6-23.
170. **WILLIAMS WL.** The therapeutics of colic. Amer Vet Rev 1894; 19: 457-473.
171. **WILLIAMS WL.** Veterinary obstetrics, including the diseases of breeding animals and of the newborn. Ithaca, the Author, 1909.
172. **WILLIAMS WL.** Veterinary obstetrics. Ithaca: the Author, 1917. 2nd ed. 1931; 3rd ed. 1940; 4th ed. 1943.
173 **WILLIAMS WL.** Diseases of the genital organs of domestic animals. Ithaca: the Author, 1921. 2nd ed. 1939; 3rd ed. 1943.
174. **WILLIAMS WL.** Parasitic ictero-hematuria of sheep. Vet Mag 1895; 2: 497.
175. **WILLIAMS WL.** Teratology of the hyo-mandibular gill slit in the horse. Am Vet Rev 1904; 28: 2202-255.
176. **WILLIAMS WL.** The problem of teratology in clinical veterinary practice. Cornell Vet 1936; 26: 1-33.
177. **WILLIAMS WL.** The air sac mite of the fowl. Amer Vet Rev 1898; 22: 8-25.
178. **WILLIAMS WL, FISHER CW, UDALL DH.** The spavin group of lamenesses. Proc 42 Ann Meet AVMA 1906; 283-333.
179. **WILLIAMS WL.** Enzootiac cerebro-spinal meningitis in horses. Fourteenth Ann Rep Bureau Animal Ind for 1897; 179-184.
180. **LAGERLÖF N, WILLIAMS WL.** Researches concerning the morphologic changes in the testicles of sterile and subnormally fertile bulls. Cornell Vet 1934; 24: 361-384.
181. **WILLIAMS WL.** Recollections of and reflections upon sixty-five years in the veterinary profession. Cornell Vet 1945; 35: 166-190, 231-269.
182. **WILLIAMS WL.** The veterinary profession: its opportunities and needs for the future. Amer Vet Rev 1888; 12: 153-160.
183. **WILLIAMS WL.** Book review of Ernst Joest's Spezielle pathologische Anatomie der Haustiere. Cornell Vet 1926; 16: 310-316.
184. **LEONARD EP.** In the James Law tradition, 1908-1948. Ithaca, N.Y. State Coll. Vet. Med., 1982; 222.

185. **SAUNDERS LZ.** Peter Olafson 1897-1985. A eulogy. Cornell Vet 1986; 76: April, unnumbered 1-4.
186. **McCREA T.** The influence of pathology on the clinical medicine of William Osler. Bull Int Assn Med Museums (Osler memorial no.) 1926; No. 9: 37-41.
187. **SCARLETT EP.** Philatelic Osler. Group Pract 1969; 18: 60-61.
188. **BEAN RAB, BEAN WB.** Sir William Osler. Aphorisms from his bedside teachings and writings. New York: 150; 79.