

American College of Veterinary Microbiologists where he served a number of roles, including that of secretary-treasurer and business manager for 13 years. He was devoted to his family and enjoyed a number of hobbies. He was active as a leader in Boy Scouts for many years and in community activities. He died on March 12, 2010 leaving a legacy of accomplishment and service.

This biography emphasizes his early research career and his professional society involvements as these areas not only will be of special interest to members of the AAAP but also represent the portion of Graham's career with which this author is most familiar.

Early Years. The history of Graham Purchase reads like an "Out of Africa" novel. His paternal grandfather, Harvey George Purchase, from the Chichester area of Sussex, England, went to Northern Rhodesia as a builder. His grandmother, Grace Lillie (Page) Purchase, was a nurse missionary. After his grandfather died his grandmother carried on, caring for their son, Harvey Spurgeon Purchase, and teaching him the tribal language (Chinyanja) of the area. Harvey returned to England to finish high school and continued his education in London where he simultaneously earned a veterinary degree and a PhD. While in London, he met Vera Margaret Cooper who became his wife (1934). Soon thereafter, Harvey returned to Northern Rhodesia (present day Zambia) to the town of Livingstone where he served as a veterinarian in the British Colonial Service. His assignment was in the bush town of Masabuka, about 200 miles north of Livingstone. Graham writes that his father traveled on foot around Northern Rhodesia with 20 porters carrying packs on their heads with his tent and other life essentials to investigate and combat outbreaks of livestock diseases.

Graham was born in Livingstone on August 8, 1936 after his mother, Vera, traveling alone, made the 200 mile journey back to civilization for the event. However, the family soon returned to Masabuka where Graham lived for his first 3 years. During this time Graham's brother, Iain, was born. Then, in 1939, it was back to England for a period of scheduled home leave for Harvey. However, World War II broke out and Harvey soon was assigned to the Veterinary Research Laboratory at Kabete, Kenya.

Thus it was back to Africa, where his parents made a home in the town of Kabete, near Nairobi. Harvey, Graham's father, was employed as a research scientist at the Veterinary Research Laboratories in Kabete where he worked on a vaccine for Rinderpest. In 1948-49, Harvey went to Thailand (then Siam) to set up a vaccine production unit. For this and other achievements in the British Colonial Service, Harvey received in 1952 an OBE (Officer of the Order of the British Empire) from the Queen. After his return from Thailand in 1949, Harvey was made Chief Veterinary Research Officer at the Kabete laboratory.

Graham did his primary education in Kenya at a boarding school in Nakuru, about 100 miles west of Nairobi. In 1947 he returned to England with the family for a year while his father was in Thailand and attended school in Danes Hill, Oxshot, Surrey. He then returned to Kenya where he finished high school at the Prince of Wales School for boys in Nairobi, also a boarding school.

In 1952, before Graham's high school days were complete and at a time of increasing civil unrest in Kenya, Graham's father retired from the British Colonial Service and accepted a new job as director of Cooper and Nephews, a British Veterinary Supply Company located in Johannesburg, South Africa. Graham's parents left Kenya for South Africa (via England) in April. Iain was sent to boarding school in South Africa. For much of the year, Graham remained on his own in Kenya, where he finished his high school education in the fall of 1952, passing the British Ordinary Level exams. His brother notes that Graham not only survived but had outstanding examination results which allowed him to be accepted into the University of Witwatersrand at the age of 16, essentially one year early. In Iain's words, "as an adolescent he (Graham) had shown his ability to work on his own, organize and manage his affairs and still perform brilliantly academically." After graduation, Graham proceeded to join his family in Rosebank, a suburb of Johannesburg.

University education. Wanting to become a veterinarian but still too young to enroll in veterinary college, Graham entered the University of Witwatersrand in Johannesburg in January 1953. Less than three years later, in November 1955, he received the B.Sc. degree, majoring in botany and in biochemistry. On the selection of botany as a major field, Graham followed the advice of his father that he would learn enough about animals in veterinary school so he might as well study plants first. Nancy also explains that Graham wanted to enter veterinary school with his brother, necessitating that he "kill some time" at the University of Witwatersrand waiting for Iain to catch up. In Johannesburg, much of Graham's social life centered around the Rosebank Union Church where he and his brother sang in the choir. This was something of a new experience since Iain notes there was no nearby church in Kenya. Graham continued to participate in Church choirs for the rest of his life.

In 1956, he entered veterinary school at the University of Pretoria in Onderstepoort, South Africa, along with his brother, Iain. One of the challenges was that some courses were taught in English and others in Afrikaans. Graham was less than fluent in Afrikaans and survived by taking a dictionary to class. From Iain's account, college days were fun for both brothers. There were pranks (Graham became known for pranks in his later life), social life and dances, and opportunities to repair the old car they shared. Both brothers graduated in 1959, receiving B.V.Sc. degrees. Iain notes that his brother was the only one in his class to receive his degree *cum laude*. Both brothers made plans to go into research, no doubt influenced by their father's successful career.

Again following advice from his father, Graham first opted for some training in private veterinary practice. He joined a 14-person veterinary group that Graham had worked with the previous summer. He was quickly appointed as the house surgeon and lived on the premises. It was during this period that Graham wrote his first technical case report, describing a blood disorder of dogs (J. S. African Vet. Med. Assn., 1960). This was followed by another case report on toxicity in horses (1961). Graham's proclivity for publication generation was already evident.

During this de facto internship, he was busy laying plans for the rest of his career. Several applications for graduate fellowships at veterinary colleges in the United States brought no positive response. However, in 1960, a fateful meeting occurred in South Africa between Graham and Dr. Paul DeLay, the Director of the Plum Island Animal Disease Laboratory in the United States – part of the ARS, USDA network. DeLay was in Africa to visit Graham's father (both persons shared an interest in exotic disease research and vaccine development). Graham saw this as a moment of opportunity, ditched his girl friend, and took DeLay to a live performance of "Wait a Minum" (a South African spoof) to talk more with DeLay. The evening must have gone well as DeLay proposed that Graham apply for a position at his laboratory which must have sounded interesting as the Plum Island laboratory was working on exotic and highly dangerous diseases of farm animals. He quickly sent off an application and soon thereafter made plans to move to England where he would take care of some needed business while waiting for a response. He would also visit his brother who had recently married, moved to England, and was living in Cambridge.

The England Period. In London, Graham registered as an M.R.C.V.S. (Member, Royal College of Veterinary Surgeons). This was a necessary certification for any veterinarian to be licensed to practice in England. Since England had a reciprocal arrangement for registration with the University of Pretoria for veterinarians, Graham's degree was accepted in England without the need for additional examination. During this period, Graham did "locums" in Cambridge and Yorkshire (locums are temporary positions where one works for a local veterinarian while he goes on vacation). Graham did several of these tours while waiting for word about his application for the job at Plum Island and his immigration visa. On one of these locums, the veterinarian had a sailboat which Graham was allowed to use on his days off. Accordingly, Graham taught himself to sail and thus launched a life long interest in sailing.

After a number of months he ultimately learned that he was not qualified for employment at the Plum Island laboratory apparently based on citizenship issues. Graham wondered why, if this was true, that information could not have been communicated earlier. It seems that his paperwork had become buried on somebody's desk in the USDA's Agricultural Research Service (ARS). This was Graham's first taste of the vagaries of US Federal Service, where he would spend a large part of his professional career.

Apparently motivated by guilt associated with the paperwork delay, ARS made an effort to locate another position for Graham and notified him of a position with another ARS laboratory, the Regional Poultry Research Laboratory (RPRL) (now Avian Disease and Oncology Laboratory) in East Lansing, Michigan. Although Graham's veterinary orientation was not directed at all towards poultry, after seeking his father's counsel he applied (1961) and was quickly accepted.

The reasons why citizenship barred Graham from consideration at Plum Island but was not a problem in East Lansing are not totally clear, but veterinarian scientists were at that time considered to be in a shortage category – meaning that citizenship could be waived as a condition of employment and immigrant visas could be granted. Plum Island, in

contrast, worked on highly sensitive research where citizenship may have been an absolute requirement.

Before leaving England, Graham had the chance to visit with Peter Biggs at the Houghton Poultry Research Station. Biggs was working on avian tumor viruses and would later play a significant role in Graham's career.

The Michigan Years – a time of research and discovery. Graham arrived in New York on October 10, 1961 after a long trip from Southampton, England on the Queen Mary (a large passenger ship of the Cunard Line). Upon his arrival in East Lansing, he was welcomed by Berley Winton, the laboratory director, and by Ben Burmester who undoubtedly had been involved with his recruitment and would play an important role in his professional career over the next decade. Lodging was arranged in rather primitive faculty apartments at Michigan State University. He proceeded to commence his work with the enthusiasm and sense of purpose that would characterize his life.

The early research. Graham joined a laboratory that was already well known for its contributions to knowledge on avian leukosis, a type of lymphoid tumor that occurs in chickens. Ben Burmester had placed the RPRL on the map by identifying the causative retrovirus of avian leukosis and developing model systems for studying the disease in chickens with differing genetic susceptibility to the disease. The laboratory was undergoing a change in personnel at that period. Many workers from the 1950s had left or were leaving and a new team was being recruited. Among Graham's new colleagues were William (Bill) Okazaki and Lyman Crittenden. With scientific leadership from Burmester, the laboratory was focused on avian leukosis research, trying to understand the increasingly severe outbreaks of disease being reported from the field.

According to Nancy, during his first winter in Michigan, Graham had only a trench coat for warmth and no car so nearly froze. He ran from one heating grate (in the ground from the MSU heating plant) to another to warm up on the way from Cherry Lane Faculty housing to the laboratory and back. He did not realize that the first paycheck would not arrive until after the first month, so nearly starved in the interim, surviving on chicken wings for dinner. He finally had enough money to purchase a new Chevy Corvair which he kept going for many years, with numerous repairs.

In his first year at RPRL, Graham launched a Master's degree program at Michigan State University with Charles Cunningham as his major professor. Cunningham was an authority on infectious bronchitis virus and a good friend of Burmester. Thus it was no surprise that Graham chose to do his Master's research on infectious bronchitis, focusing on an isolate obtained from the closed RPRL flock. Graham received his M.S. degree from Michigan State University in 1965. His thesis was entitled "Epizootiology of an Isolate of Infectious Bronchitis Virus and its Pathogenicity in Genetically Different Chicken Embryos."

Considering the historic research focus of RPRL, it was logical that Graham's first research project was on avian leukosis. In fact, this subject would prove to occupy his

interest and attention for many years, more even than the work on Marek's disease for which he became exceptionally well known. However, lymphoid leukosis (the disease caused by avian leukosis virus) was difficult to study, requiring many months to develop in experimentally inoculated chickens. Thus it was natural that Graham would make his initial contributions in the area of technique development which could be accomplished inside the laboratory. His first authorship at RPRL was on a paper by Okazaki on complement fixation tests for avian leukosis. In April 1962, only 6 months after his arrival, he gave a report on fluorescent antibody (FA) techniques at an Avian Leukosis Conference at East Lansing (now considered a historic event). He would go on to become an expert in FA technology, a relatively new technique at the time that Graham would use to good advantage in much of his work at East Lansing. Indeed, he taught the FA technique to this author. Graham was good at techniques, was an early adopter, and was a vigorous proponent of the newest technologies throughout his career.

His contributions to knowledge in avian leukosis continued with co-authorships on papers by Torgny Fredrickson on epidemiology and a landmark paper by Robert Good and colleagues from the University of Minnesota on the central role of the bursa of Fabricius on the ontogeny of lymphoid leukosis (the primary tumor caused by avian leukosis virus). His first senior-authored paper in the leukosis field (1964) was again on techniques – the cell culture growth of Rous sarcoma virus. Interestingly, in 1965 Graham authored an 18 page review article on Rous sarcoma virus in *Avian Diseases*. This was notable for its precociousness as Graham had only worked in this field for a short time and reviews were traditionally done by world experts. There is no doubt; however, that Graham truly understood this rather complex system better than most. Furthermore, there was a strong interest at that time by many persons in the field for this type of information. This also illustrates that Graham was not reluctant to express his knowledge, which in this subject was substantial indeed.

Ben Burmester, an outstanding scientist in his own right, became director of RPRL in 1964. Ben recognized Graham's exceptional ability as a scientist and provided guidance and opportunities that certainly furthered his career.

It is safe to say that Graham became a world expert in avian leukosis in chickens during his tenure at RPRL. In fact, he was senior author with Ben Burmester on the chapter on avian leukosis published in the 6th edition of *Diseases of Poultry* (1972), the prestigious "bible" of the poultry disease world. This authorship undoubtedly was courtesy of Ben Burmester, the senior person in the field, who was by this time the Laboratory Director and highly preoccupied with other issues. Graham also was busy at this time with other research (as will be explained) but did not hesitate to accept this additional task.

In 1962, Graham met Nancy Ruth Schneider, a student at Michigan State University who was working on her bachelor degree in Nursing, having come from Illinois where she was already a Registered Nurse. They met at a meeting of the Michigan State University Sailing Club which operated very small sailboats on nearby Lake Lansing. Nancy tells the story of how she and Graham attended a surreptitiously arranged "grasser" (beer and hot dogs in a farmer's field) for the sailing club, most of whom were under-aged.

Graham and Nancy were married in July 1963. Adventurous behavior and sailing would remain a part of both of their lives.

Marek's disease and the England sabbatical. While the work on avian leukosis was going on, problems with lymphoid tumors in the field were becoming more serious. Importantly, it was increasingly evident that this was a different disease, which was ultimately termed "Marek's disease (MD)" in honor of the Hungarian pathologist who first described it. Under Burmester's leadership, the RPRL began the process of re-orienting its research program to this new disease entity. Dick Witter was recruited in 1964 by RPRL to work exclusively on MD. About the same time, Burmester arranged a scientific exchange with his good friend, Peter Biggs, who was Head of the Leukosis Unit of the Houghton Poultry Research Station (HPRS) in England. Graham would go to HPRS for a year and L.N. (Jim) Payne, a prominent HPRS scientist, would come to RPRL. This was to start in the spring of 1965.

The Payne family arrived in East Lansing (before Graham's departure) after a rough (stormy) voyage as Dinah Payne (Jim's wife) got the measles aboard the ship and Jim and three young children were quarantined in their cabin with her. Graham and Nancy had moved out of their 1-bedroom apartment and transferred their furniture to a 2-bedroom apartment for the Payne family. They lived with Ben Burmester and his wife for a short time waiting for their departure. Their bags and trunks were packed but official approval for his departure to England was delayed. They missed their scheduled boat and ultimately were flown to London at considerable extra expense to the US Government, a circumstance all too familiar to Government employees.

Graham and Nancy moved into the Payne's 15 room Queen Anne historic house, complete with 7 outbuildings and farm animals but lacking amenities such as central heating or insulation. Nancy remembers this as the coldest year of their lives. Payne, in contrast, moved with his wife and 3 small children into Graham's tiny 2 bedroom faculty housing unit at Michigan State University without complaint, but adjustments were needed in both cases.

The purpose of Graham's sabbatical (termed "training" by the USDA) was to study MD. The HPRS had already made significant progress on this disease and Biggs was one of the authorities. Indeed, the HPRS and RPRL were similar in many respects – both government and both dedicated to the study of avian tumors. Graham used his time well. He contributed to 3 significant reports (2 of which were senior-authored) on "acute MD" and the viruses that caused this syndrome. More importantly, he had the chance to participate in the emerging field of MD research at the laboratory which just 2 years later would become famous for its isolation of the causative virus and development of the first vaccine. This was a place where good science was happening.

Graham and Nancy purchased a Volkswagen camper in England and used it for weekend travel through England, Scotland and Wales, and even took it to Europe for a summer vacation. At the end of the year, Graham and Nancy flew to Kenya for a vacation and then to South Africa to visit Graham's parents before returning to East Lansing.

Back to East Lansing. Graham and family returned to East Lansing in spring 1966, with Graham full of enthusiasm and ready to shift at least some of his research focus to MD. Presumably, this is exactly what Burmester had in mind. After what Nancy remembers as considerable soul-searching, he proceeded to initiate a PhD program at Michigan State University, again under the tutelage of Charles Cunningham. This time the subject was MD, specifically the characterization of new strains of MD virus, which could now be grown in cell culture.

Here starts a period of unparalleled research productivity for Graham. He initiated important new programs on MD. He continued his prior interest in avian leukosis. He also contributed knowledge about reticuloendotheliosis virus (REV), a new type of retrovirus that could also cause tumors in chickens.

In the fall of 1968, Witter isolated a new herpesvirus from turkeys in Indiana. Graham contributed to this important work by demonstrating by FA tests that the new virus shared antigens with MD virus. However, as this new virus proved to be apathogenic in chickens (and turkeys) and as an attenuated MD virus had already been shown by English workers to be protective against MD, it was fairly obvious that the new turkey virus should be evaluated as a potential vaccine.

Actually, this idea fit into work already underway by Bill Okazaki. Okazaki had prepared several attenuated MD strains using the protocol of the English workers and had already established an assay system to evaluate their ability to protect against challenge with virulent MD virus. Witter volunteered his new virus for testing by Okazaki who worked as a member of Graham's research team. Graham was no doubt involved in this first challenge trial. When the first results in chickens showed high levels of protection, there was a general excitement in the laboratory. Burmester correctly perceived that the lab had something big and directed Graham to organize and lead a crash program to develop the new vaccine within the year, a task which Graham took on with enthusiasm. Okazaki conducted most of the early protection studies. The landmark paper by Okazaki, Purchase and Burmester (1970) that described protection by HVT under laboratory conditions became a classic. For reasons not obvious either then or now, Witter was not a collaborator in these early trials or an author on this paper. To the recollection of this author, it was not an important issue at the time (although it was also not obvious how important this work would prove to be). An important oral report on the isolation and characterization of HVT was presented by Witter in June 1969. This report revealed, as a side note, that the "protection studies were promising." The cat was out of the bag. Okazaki's presentation one month later provided the protection data and the race towards a vaccine was on. Graham was a co-author on both presentations.

By this time, Graham had jumped in with both feet and was effectively managing a comprehensive program of field testing (to determine efficacy) and safety testing of the new vaccine. By prior agreement, the RPRL data was turned over to both State and Federal licensing authorities to speed the approval of the new product. Graham was the point person working with these licensing agencies. A state license was issued in

Michigan in 1971 and the federal license (to 3 companies) followed in March 1972. All persons agreed that the speed with which the HVT vaccine proceeded from the first trials to commercial licensing and production was unprecedented. For the poultry industry, this could not have come too soon. Much of the credit for the efficiency of this process belongs to Graham.

From a purely academic viewpoint, the development of the HVT vaccine was good solid work but not that unique in terms of historical precedent. What made this discovery special was its impact. The vaccine reduced the incidence of disease by more than 90% after only a few months of use. Suddenly, there were too many chickens. Everybody got on the bandwagon to extol the virtues of this accomplishment. There were several really big reasons. First, there was great economic benefit for the poultry industry – in fact, one might say this discovery “saved” the industry. Secondly, MD was a type of cancer and there were no vaccines available at that time for any type of cancer in any species. Third, the HVT vaccine was the only MD vaccine licensed in the US. The English vaccine reported earlier was never used here, and ultimately proved less desirable compared to HVT anyway. Thus, HVT became the standard control for MD throughout the world. Graham, as the point person along with Ben Burmester, became famous. The awards and recognitions were soon flowing in. Graham had the distinction of being in the right place at the right time, and was a key participant in what most scientists would call “the discovery of a lifetime.”

There was ample credit for all. The RPRL received a Distinguished Service Award from USDA. Purchase, Okazaki, Burmester and Witter all were credited with roles in this achievement and, as a group, obtained one of the first patents on USDA-developed technology.

As another capstone for this chapter, Graham received his PhD degree from Michigan State University in 1970. His thesis, “Marek’s Disease: Virus-Host Cell Relationships in Vitro and in Vivo, and Biological Markers for Cloned Preparations of the Virus and a Herpesvirus of Turkeys, 1970” was prepared as a collection of 5 journal articles preceded by an introduction and literature review – all bound together. Three of the articles were published and included as reprints in the body of the thesis. Apparently, this was the first time that Michigan State University had approved a thesis in this form. This work entailed the characterization of several MDV strains in common use at the time, including their growth in cell cultures and chickens. The 3rd paper in the series, described viral antigens in a variety of tissues and organs of infected chickens, including the feather follicle epithelium. This work confirmed the recent landmark discovery by Bruce Calnek of the role of the feather follicle in transmission of the disease but was accomplished so



Graham Purchase, 1970

quickly that Graham's paper was published in the same year (1970) as the Calnek paper, thus confusing the issue of credit. As it turned out, Calnek received his due accolades for this important discovery and Graham was credited with providing valuable confirmatory data which is so essential for the progress of scientific knowledge.

The REV story. Graham collaborated easily with persons in different fields. He became intrigued by the spleen necrosis virus isolated by Trager and the duck infectious anemia virus being worked with by Colin Ludford at Michigan State University. Catherine Cook had isolated a virus from chickens with MD. Marvin Twiehaus had isolated a virus from turkeys in the late 1950s and actually worked with Burmester who discounted the work believing it to be in error. But then Martin Sevoian got material from Twiehaus and described a virus of "unusual potency and pathogenicity" in a controversial paper that became important in the field. Gordon Thielen while on sabbatical at the National Cancer Institute studied the Twiehaus virus (named by Sevoian as strain "T") and termed it a "reticuloendotheliosis" virus, based on the pathological changes induced in chickens. Graham communicated with all these persons and collected these several strains, probably out of curiosity but also because they seemed to be associated somehow with tumor formation in avian species.

Graham helped Witter with a publication (1970) showing that these new viruses were capable of causing nerve lesions in chickens. This finding was interesting because previously only MD virus was thought to induce nerve lesions. Graham received sera from Tom Grimes and helped show through FA tests that REV was the cause of an outbreak of tumors in ducks in Australia. He also published with Ludford on duck infectious anemia virus. His seminal publication (1973) lumped many of these strains into what he termed as the "reticuloendotheliosis virus group." This paper defined a terminology that survives to this day and essentially launched a new field of scientific endeavor. Again, FA tests were used to show immunological relationships between the various strains. A subsequent review paper authored by Graham solidified this terminology and described characteristics of several REV strains.

Continuing with avian leukosis. The avian leukosis viruses (ALV) and their associated tumors (lymphoid leukosis) were Graham's first research priority. After the return from England he picked up with some of the ongoing research at RPRL. Bart Rispens, a Dutch veterinary researcher, spent part of a year in Graham's laboratory in 1966 doing work on avian leukosis. Rispens would later become well known for isolation of a popular vaccine strain of MD virus. A big epidemiology study was conducted at Creighton Brothers in Milford, Indiana that involved many field trips with a huge number of samples. This study, aided by Darrell Johnson from USDA, APHIS and John Solomon, a colleague at RPRL, was published in 1969. Graham was both well informed and well known in the field. He welcomed interaction with outside scientists with a basic interest in avian leukosis as a model for cancer. Thus, in his latter years at RPRL he contributed to fundamental work by Max Cooper, Paul Nieman, Doug Gilmour, G.J. Thorbecke and Norman Cheville – world-class researchers all – who appreciated Graham's command of both basic and applied research and valued his access to chicken tumor models not available in most laboratories. He also guided the graduate studies of Carlos Romero on

immunology of lymphoid leukosis and, importantly, he mentored Aly Fadly in the discipline of avian leukosis after his arrival in East Lansing (see later). Some of Graham's work extended well past his physical departure from the RPRL in 1974. His last paper on ALV was published with Okazaki in 1982.

The East Lansing years – the social dimension. After starting their marriage life in Michigan State University faculty housing and soon after returning from the sabbatical in England, Graham and Nancy bought a new house in Okemos where their two children, Deborah (1967) and Kenneth (1969), were born and raised. Nancy comments that “Graham was a dedicated Father who played as hard as he worked.” There was enough land for a vegetable garden, grape vines and fruit trees and enough space in the cellar for parties and the production of homemade beer (of questionable quality). Nancy relates that “after the first batch smelled up the basement so badly, she made him make beer in the garage. He used a small fish tank heater to keep it warm, which worked very nicely. He had a capping machine for bottling. The worst part was drinking the really cheap brew that Graham had bought just to have the bottles for his (homemade) beer.”

Graham and Nancy purchased a share in a log cabin on Lake Mitchell near Cadillac, Michigan where they spent quality time. Skiing at the Caberfae Ski Resort, close to their cabin, provided a winter reprieve from the laboratory. Sailing their small boat, *the Nauti Nancy*, on Lake Lansing and at their cabin provided a diversion in summer. They were both active in the social fabric of RPRL, and were a catalyst for canoe trips and other similar activities. Graham and Nancy also joined the choir of the University United Methodist Church.

Time for a career decision. After 13 years, Graham was at the top of his game as a researcher in poultry diseases. He had enjoyed success and tasted the recognition and fame that accrued as a result. What would be next? Graham explains in the “conversations” article by Stalheim the several factors that he considered. First, his long time technician, Lee Noll, left his laboratory to work for a private vaccine company. Second, “after writing hundreds of short reports of experiments, the thrill or zest slackened somewhat.” Also, it may have appeared that the problem with MD was solved, although such a conclusion was surely premature.

In 1974, Graham left RPRL for a position with the ARS National Program Staff in Beltsville, MD. The Chief of the Animal and Veterinary Sciences section of the National Program Staff at that time was Terry Kinney, already an important person in the hierarchy of ARS. Graham surely appeared flattered by the confidence placed on him by Kinney after the appointment was announced, and was excited about the prospects of a new career in research administration. His position was a promotion and one of the few routes of professional advancement within the ARS. Nancy remembers that Graham considered this position as a ‘higher calling.’ However, it was a fateful decision as Graham never again returned to the bench.

Before his departure from the RPRL, Graham left a carefully prepared list of important reagents as well as a number of virus strains and antibodies with this author, some of

which continued to be used for years. Similarly, he turned over many 2x2 kodachrome slides illustrating lesions of avian leukosis and MD. This author used one of these images in a book on tumor diagnosis published 37 years later.

The Beltsville Years – the transition from scientist to administrator. Graham and Nancy and family moved to Laurel, MD where they purchased a small home and proceeded to put in more gardens, fruit trees and grape vines. Graham jumped into his new position as the National Program Staff person responsible for coordinating the ARS research program on poultry diseases (later expanded to all animal diseases). Graham took his new position seriously, as was his want, and made an effort to advance research in each of the several locations under his responsibility. One of these locations was East Lansing, and thus Graham was in close touch with and a frequent visitor to his former laboratory. During this period he authored several reports on administrative issues and priority setting. He kept in touch with current developments in disease incidence in the field. He encouraged this author, in the late 1970s, to take a look at the increasing incidence of MD in the Delmarva poultry industry. I did, and as a result I focused on new MD virus strains and the vaccines needed to protect against them for the rest of my career. Graham's efforts also provided a much needed program increase (money) to the RPRL in East Lansing, which advanced the cause of tumor virus research.

In 1976, Graham was at Purdue University on a visit and met Aly Fadly, a young faculty member who had earned his DVM in Cairo, Egypt and who had just finished his Ph.D. with Roland Winterfield. Graham explained that his old position at RPRL was still vacant and suggested that that Fadly should apply. Fadly applied and was interviewed by Graham, Dick Witter and Ben Burmester at the 1976 AVMA meeting in Cincinnati – while sitting in a bar. Fadly, an expert on adenoviruses, joined RPRL in late 1976, prompted in part by opportunities to work on infectious bursal disease and hemorrhagic enteritis of turkeys, new initiatives established at RPRL with the approval of Graham in his administrative role at Beltsville.

Once in East Lansing, however, Fadly quickly found that his primary research focus would be on retroviruses, especially avian leukosis. Here was an area where Graham could help. Fadly remembers that “(Graham's) love for planning, conducting and analyzing research let him travel to East Lansing to be an active participant in the discussion and execution of these avian leukosis research experiments. Graham had a great passion for good science through excellent planning and execution of experiments. He never hesitated to indicate to any scientist that there was something wrong with their plans or results. Although Graham has been known for providing constructive and frequently harsh critiques to various scientists, I had a very cordial relationship with him.” Fadly collaborated with Graham on early avian leukosis work and went on to his own distinguished career at the RPRL, specializing in avian retroviruses and serving as Director of the laboratory (now ADOL) since 1998. This story documents the instrumental role played by Graham in the career of Aly Fadly which had a profound influence on the history of the RPRL and the field of avian tumor research.

In 1978 Terry Kinney left his position to become Administrator of ARS, and Graham was appointed as Acting Chief of Livestock and Veterinary Sciences, National Program Staff. Graham's star was still rising but by now he was concerned with, and was the official spokesperson for, a broad reach of programs cutting across all livestock diseases. He had responsibility for program planning, coordination, review and evaluation of many programs with an aggregate budget of \$250 million. He supervised 9 National Program Staff positions. This was high profile and demanding work, with few of the immediate rewards associated with his former research career. One had responsibility for many programs and types of research. However, the power to direct these programs was shared with the Line Managers (Area Directors) and effecting change was administratively and politically challenging. No doubt this was attended by an ample amount of stress and frustration. He remained in an "acting" position for 2 years, a much longer period than was usual and customary (according to Nancy).

In November 1982, Graham moved into another administrative position with ARS in Beltsville. This time he was designated as a Scientific Advisor to the Director of the Beltsville Agricultural Research Center, the largest of the ARS units with 400 scientists and 1200 employees. His areas of interest broadened to include a wide range of programs in animal and plant sciences.

This was also the dawn of the new biotechnology era. As an early adopter, Graham was quick to recognize the potentials of molecular biology, genetic engineering, recombinant DNA and related technologies. This became something of a crusade. Although Graham had probably never used such techniques in the laboratory, he became well acquainted with the underlying science. He extolled the virtues of biotechnology and helped speed adoption by scientists at Beltsville and elsewhere. Graham was especially proud of his 1984 report "Agricultural biotechnologies: strong acceleration of research programs at Beltsville," which garnered a good deal of interest throughout ARS. He proceeded to author 8 publications and abstracts on the subject of biotechnology from 1985-1990.

Graham reflects positively about his ARS experience in the "conversations" book by Stalheim. When asked about this experience, Graham answers "ARS is a fine organization with an important mission. Because of its accomplishments, Americans live better, eat better, and are clothed better. Chicken, for example is cheaper here than anywhere else in the world, due, in part, to veterinary research but also to advances in production methods and our free market economy." What is lacking in this statement is what ARS has done for Graham. As a long-time friend of Graham's, I am aware that the administrative experience was stressful and that at least some of the time it was difficult to derive a high sense of satisfaction from the work. No doubt it was also difficult to consistently meet the expectations of persons above him. Graham never hesitated to give advice and diplomacy was not an ingrained attribute.

Nancy confirms that Graham became discouraged with his situation which was increasingly fraught with politics and because his relationship with Kinney, now ARS administrator, had deteriorated. Graham felt things had reached a point where he had to get out. It was a difficult decision as both children were at the University of Maryland at

the time. According to Nancy, Ken said, “Most kids grow up and leave their parents, my parents are leaving me!” Of course, this was similar to Graham’s own situation years earlier when his parents left him in Kenya to finish his schooling while they moved on to another location.

The Mississippi Years. Thus it may have been something of a relief to accept, in August 1988, a position as Director of Research in the College of Veterinary Medicine, Mississippi State University. He also became Associate Experiment Station Director. Graham explains in the Stalheim book that he was impressed with the diversity of research programs and especially with new physical facilities. Graham could get back to avian medicine but also had to take on aquaculture and other basic fields. Graham also comments on his desire to “return to the veterinary fellowship.” His veterinary background was of little value for him in ARS administration but at Mississippi State, he was surrounded by veterinarians. Finally, he was impressed by the established research matrix in place – a testimony to Graham’s focus on structure and process and a carry over from his Beltsville days. It seemed to Graham to be a good fit, although to his friends it seemed a bit like going to the end of the earth. At least in this author’s opinion, Starkville is not on the beaten path to anywhere.

However, it turned out that Starkville was a comfortable location for the family. Nancy says, “Graham and I grew to love Starkville, a college town of 13,000 people with another 13,000 students when school was in session. We were part of the faculty and all the campus activities, joined Trinity Presbyterian church and sang in the choir, drove 50 miles for square dancing, etc. We loved the small town atmosphere of Starkville and the fact that anywhere we went we would meet someone we knew. Americana at its best!”

As director of research, Graham guided the construction of a new animal research facility designed to raise small ruminants free of internal parasites. He helped to establish a Center for Environmental Health Studies and a Center for Biomedical Studies – initiatives to take advantage of the strengths of the resident faculty. He boasts that he raised the quality of research, increased the amount of research funding, and also the number of publications. He established peer review systems. He also established Best Paper and Grantsmanship awards for the faculty, and other incentives for group performance. Besides contributing to several staff research projects, resulting in joint-authorship publications, he also wrote on topics such as “veterinarians in aquaculture” and “veterinarians in animal production.” Graham surely felt a sense of accomplishment concerning many aspects of his responsibilities at Mississippi State. However, like every administrator, Graham found it impossible to do his job and still keep everybody content. Not afraid to take action, Graham lists in his CV that he has “dismissed 1 faculty and 3 support persons without legal repercussions.”

As associate director of the Mississippi Agricultural and Forestry Experiment Station, he directed experiment station research on food safety, aquaculture and animal biotechnology. He was active in the Southern Association of Agricultural Experiment Station Directors, serving as secretary. He provided advice on relevant topics to the Food and Drug Administration and to the USDA Food Safety and Inspection Service.

Eventually, Graham decided that another move was in his best interest. He had been in Mississippi for 10 years and was looking for a career change and a new scientific challenge. Proximity to his family on the east coast and access to quality health care were other reasons for contemplating a move to the east. Nancy says “Even though my parents were in a retirement center, I felt I needed to be closer to them. Also, our daughter was getting married and preparing to settle in Virginia. It was time to come home.”

The Pennsylvania Years. With these considerations in mind, Graham moved to Pennsylvania in October 1998 to take on the position of Director of the Pennsylvania Animal Diagnostic Laboratory in Harrisburg. This was a large laboratory that had its own share of problems. Again, Graham jumped in and started dealing with a laundry list of issues. He was able to improve the quality of the science and technology, but there were personnel issues and the relationship with the employee’s union was especially difficult. Although some employees considered Graham to be the “best director they had ever had,” the job soon became all about personnel and union issues, rather than the science that was Graham’s interest and forte. Restrictive union policies were frustrating and, in Graham’s opinion, were no way to run a lab. Because of these matters and some emerging health issues, it was not long before Graham started contemplating his retirement. He purchased property on Vines Creek, an estuary off the Indian River which flowed to the Atlantic, in Dagsboro, Delaware. The house in Pennsylvania sold quite quickly, so Nancy moved to Delaware in July 2000. According to Nancy, “Graham couldn’t retire until December 2000, so he took a small depressing basement apartment near the laboratory for 6 months. He traveled back and forth to Delaware for the weekends, which proved to be very tiring. He said it was the worst 6 months of his life.”

Graduate Students and Colleagues. During his latter years at RPRL, Graham guided the research programs for two graduate students, at least in part. Inguna (Inny) Fauser, graduate student from the Microbiology Department at Michigan State University, worked on delayed hypersensitivity and other immunological aspects of tuberculosis and MD, publishing the results of her Ph.D. thesis work in 1973. In her thesis (1974), Fauser thanks a number of persons, and strangely includes only a cursory nod to Graham for help “in performing necropsies and pathological diagnoses”, but given the nature of the work and my recollection of the time, Graham clearly had a significant role in her research, much of which was conducted in Graham’s lab at RPRL.

Carlos Romero, graduate student from the Poultry Science Department at Michigan State University, worked on the prevention of lymphoid leukosis by the androgen analogue, mibolerone, which induced early atrophy of the bursa of Fabricius. Romero’s Ph.D. program spanned the period 1973-1977. Romero recalls that “Graham was paramount in my coming to East Lansing to work on Marek’s disease, although I ended up working in the LL field. He (Graham) was very bright and constantly fed me ideas for my research, some of which I managed to implement. I think looking for ALV group-specific antigen in eggs of my viremic hens was one of them and it all worked out well in the end. Although critical most of the time, he was a good friend and I always felt that he was a

very prolific mentor.” Graham was in Beltsville during most of this period and did not continue formally on Romero’s committee, but nonetheless continued to provide input via long distance. Romero credits Graham and Ben Burmester as architects of the original project which also involved Fred Frank of the Upjohn Company, the producers of the drug under study. The four papers describing Romero’s work were published in 1977 and 1978. Romero went on to a strong career in veterinary research and is currently professor at the University of Florida.

During his tenure at RPRL and later, Graham had a commanding presence that surely influenced his professional colleagues. The story of Aly Fadly was related earlier. For several years, Graham supervised Bill Okazaki and provided research guidance that, although sometimes not highly appreciated by Bill, helped him increase his productivity and value to the laboratory. My own early career paralleled Graham’s, at least for a time. Always more technologically advanced, he taught me fluorescent antibody techniques and even advised on histopathology and the design of my experiments. Some of this advice was not solicited, but in retrospect was valuable. Graham was very well organized, a trait I instantly appreciated and learned from. Fueled by his intellect and energy, he was a high achiever and ran in elite company. To me, Graham had many characteristics worth emulating, but was not always the easiest person to work with. I am thankful for his suggestion in the late 1970s to redirect my personal research towards the characterization of new strains of MD virus. I acted on this suggestion and the course of my research for the next 20 years was set. Our relationship was always congenial and grew closer with the passing years. An hour with Graham was always a learning experience.

Contributions to the AAAP. Graham joined the American Association of Avian Pathologists in 1965. A long time member of the Tumor Virus Committee, he also served as Director at Large for two years (1978-80). He was on the editorial committee for the first 2 editions of *Isolation and Identification of Avian Pathogens* and chaired the committee for the 3rd edition (1988). He was also on the editorial committee of the 2nd edition of the *Avian Disease Manual* (1982). He was the first chairperson and a long time member of the biotechnology committee (appointed by this author in 1988). He served on the editorial board of *Avian Diseases* from 1973 to 1996.

Perhaps his most distinctive and important contribution was his role in conceptualizing, advocating, and ultimately forming the American College of Poultry Veterinarians (ACPV). As a member of the American College of Veterinary Microbiologists and also with experience on AVMA’s Advisory Board on Veterinary Specialties, Graham brought significant experience to the issue of a specialty board for avian pathologists. He and Simon Shane jointly advocated for the establishment of a new organization. Ultimately, the various concerns and objections were overcome and the ACPV was founded in 1991. Graham was a founding diplomate. This organization continues to thrive and has become an important way for poultry veterinarians to establish their competency and thus further their professional careers. One may question whether the founding of the ACPV is properly referenced as an activity of the AAAP. The two organizations are totally separate, but at the beginning all of the seminal discussions and organizational activity

was conducted within the AAAP, and all the founding members of the ACPV were also distinguished members of the AAAP.

In addition to the above, Graham frequently attended the annual meetings of the AAAP and maintained his relationship with AAAP members through and after the time of his retirement.

Other Professional Organizations. Throughout his career, Graham participated actively and effectively in many other professional organizations and societies.

American College of Veterinary Microbiologists (ACVM). Graham became a diplomate of the ACVM in 1967. He was rightfully proud of this distinction which required competency in a variety of subjects and surely required much preparation time to pass the rigorous examination. He made service to the ACVM a priority in his life for many years. He served 9 years as Executive Director and Secretary-Treasurer (1989-1997) during which time he published 4 newsletters a year, organized two national meetings and assorted other symposia and banquets. Through his efforts the ACVM became a tax-exempt 501 (c) (3) organization. He was the ACVM's representative on the AVMA's Advisory Board on Veterinary Specialties (1984-88), an assignment which provided an essential background for his later efforts in founding the ACPV (see above). He served on a number of other committees, including the Board of Governors.

Poultry Science Association (PSA). Graham had a long association with PSA, commencing in 1963. He was actively involved on the program committee for several meetings, including a role as overall chair for the Iowa meeting in 1985. He also served 13 years on the editorial board for the journal, Poultry Science and participated in numerous committees.

World Veterinary Poultry Association (WVPA). It is not clear how Graham became involved with this group, which is composed largely of international scientists and poultry specialists with strong roots in Europe. However, his mentor, Ben Burmester, had been active in this organization and no doubt encouraged Graham to attend the meetings, which occurred at 4-year intervals. Graham joined WVPA in 1969 and most likely attended the 1973 meeting in Munich. He helped Burmester and Bruce Calnek organize the 1977 meeting in Atlanta, GA and went on to serve as corresponding secretary of the US Branch of the WVPA (1977-1982).

He lists 15 additional organizations where he held memberships. Perhaps the most important of these were the American Veterinary Medical Association, Royal College of Veterinary Surgeons, US Animal Health Association and the Conference of Research Workers in Animal Diseases. Graham clearly found personal satisfaction through his organizational work. He sought out opportunities for service and committed significant time and energy to these tasks. It was clear that professional organizational activity was a major priority in his professional life.

Publications and Recognitions. Graham's publication list numbers 216 articles, including abstracts and popular articles along with book chapters and peer reviewed papers. A large part of this collection derives from his research years at East Lansing. Not unexpectedly, the publication stream from his research years continued nearly a decade after leaving the RPRL. The "number" of publications always seemed important to him. I remember a time in the 1960s when word spread that Graham's list of publications had passed 100. This seemed a phenomenal achievement at the time (at least to me) considering he had only been working in the field a few years. The obsession with numbers aside, there is no dispute that Graham was a highly productive researcher who was willing to document his experiments. He had a large number of papers with outside collaborators of high stature. Later as an administrator, he advocated the idea that research was not useful unless it was properly documented in the scientific literature. This view also was his own personal mantra from the beginning of his career.

He was also listed, with 3 others, on a US Patent covering the discovery of the HVT vaccine against MD.

Graham was not only a prolific writer, he wrote well. He was a natural editor and became involved through his career in a number of major editorial projects. He understood content as well as grammar. His CV lists 9 major editing projects between the years 1975 and the late 1990s. Anyone who has done this knows that editing a book requires a great deal of work and time. Graham was never hesitant to accept editorial responsibilities and appeared to enjoy the work involved.

He also was a frequent speaker at technical conferences. Initially, his presentations focused on his research but later he contributed knowledge on science policy and research management. Successful speakers start by having knowledge to impart. Graham was always thoroughly informed and could speak with expertise on many fields. He lists in his CV that he made over 140 formal presentations on 6 different continents.

Graham was the recipient of a number of prestigious awards, of which he was rightfully proud. These include the Tom Newman Memorial Award (1973), the USDA Distinguished Service Award (1972), Sigma Xi Junior Research Award (1972), the CPC International Award (1971), and the Arthur Fleming Award presented to the "ten most outstanding young men and women in the Federal Service" (1972). There was also a plaque from the American Poultry and Hatchery Federation-Poultry & Egg Institute of America and a Distinguished Service Citation from the Michigan Allied Poultry Industries, Inc. All of the above were related to his role in the development of the HVT vaccine for MD.

Graham also notes that his name is listed with at least 6 different biographical publications including "International Who's Who of Intellectuals" and "Who's Who in Veterinary Science and Medicine."

During his administrative career in Beltsville, Graham was honored by an ARS Certificate of Merit and election to Gamma Sigma Delta, an honorary society in

agriculture located at the University of Maryland. While at Mississippi State, Graham received the Dean's Pegasus Award (1995) for external service to the College.

Citizenship and Nationality. Graham became a citizen of the United States in 1965. Like his parents, he was born a British citizen but lived in Africa. He continued to hold his British passport for years after becoming an American citizen, often saying that according to his father "a British passport was a passport to anywhere."

Graham never wore his British roots on his sleeve. Interestingly, Graham was known in professional circles as being "from South Africa", implying that he was a citizen of South



Graham Purchase 2005

Africa (which was incorrect) or born there (also incorrect). For some reason, Graham never clarified his citizenship and national affiliation in my presence and I believe the full story was not widely known among his professional colleagues. The reason for this is not clear – perhaps it was just a bit too complicated.

In light of the above, it is easier to understand Graham's disillusionment with South Africa in his later years. By this time, he considered the British in South Africa to be dominated by the Afrikaners and, with the abolition of apartheid, also by the native blacks. Graham told me he would never return to South Africa, a beautiful country that was so politically and culturally different from Graham's college years that he could not easily relate.

Hobbies. Graham had many outside interests. He was always reading and studying, and turned many ideas into activities or hobbies. The small sailboat purchased in Michigan also provided recreation in Maryland and Mississippi. In later years, he and Nancy would sail frequently on extended trips in the Florida Keys and the Caribbean, competently manning a rental sailboat.

Graham enjoyed the outdoors and being on water. He and Nancy co-owned a cottage on Lake Mitchell in Michigan that provided opportunities for swimming, fishing and sailing. Lucy Lee, a colleague at East Lansing, remembers accompanying Graham on a crabbing trip in Chesapeake Bay and enjoying the "catch" prepared at the Purchase home. According to Nancy, "We later owned a cottage on the Magothy River in Maryland until Ken, at the ripe age of about 10 years, said 'A cottage is a nice idea but it's just another house to clean and another lawn to mow.'"

Graham was a consummate gardener, focusing on vegetables, fruits and flowers. He enjoyed square dancing, which he and Nancy developed into a life-long activity. He liked to fix things, and build things and developed skills as an electrician and plumber. He was also a cabinet maker and produced a number of attractive pieces. He enjoyed spending time on car and home repair. Technology was a way of life for Graham, but also became something of a hobby. He participated in the Capital PC Users Club for

many years. He was always looking for the newest technological device or gadget, and delighted in explaining to friends what this new tool would do. Nancy remembers that he had the first personal computer and the first microwave among their circle of friends.

The Entrepreneur. Graham dabbled in business. He considered his experience as business manager for the ACVM as successful, and notes with pride on one of his resumes that he increased their cash reserves without the need to increase dues. Also, Graham managed 2 townhouses for more than 12 years, a project that also required significant manual labor.

Community Activities. Graham and Nancy were active in church work, singing in the choir and participating in other ways in each of their several locations. Graham was an Elder in the Presbyterian Church in Maryland. Graham was a science fair judge at the local, county and national levels. He was a leader in Cub Scouts and Boy Scouts. He organized trips to High Adventure Camps in wilderness locations from Maine to Arizona, helping his son to earn the Eagle Scout award in the process. In Mississippi, Graham and Nancy ran BSA Veterinary Explorer Post 2001. Explorer posts are made up of boys and girls who want to explore a job or profession as a possible career. He received the William H. Spurgeon award for his contributions to scouting.

In Delaware, he started a neighborhood newsletter and served on the community board. He was an active member of the Delaware Center for the Inland Bays, serving on its Citizens Advisory Committee and the Oyster Gardening program. He participated in the Citizens Water Quality Monitoring program under the University of Delaware, performing weekly tests of the water on Vines Creek. He was recognized for his many volunteer activities for these organizations. Graham and Nancy became “oyster gardeners” for research purposes. They raised 100+ oysters yearly from fingernail size to about 2-3 inches; each oyster being washed and measured monthly. Nancy remembers that “Once for fun, as we had many twins and triplets, we named them all.”

The Retirement Years. Graham and Nancy moved to Dagsboro, DE in 2000 upon Graham’s retirement from the Harrisburg Laboratory. According to Nancy “Once Graham made the decision to retire, he did it with the usual gusto he had put into everything else. He decided to leave professional business behind him and just live a little. He bought a jet boat, and with the help of our neighbor who was a fishing charter boat captain, learned to fish for everything from flounder to tuna.” Their home was on water (Vines Creek), providing beauty and ready access to water and fishing sports. Graham had time for his many hobbies, community service and his family. Graham and Nancy joined St. Matthews by-the-sea United Methodist church and choir, square danced at area clubs, kept extensive flower gardens and a small vegetable garden and became very active in local community affairs. Throughout life, and especially in retirement, Graham and Nancy did many activities together

Graham ceased to be active in his former professional fields, but kept in touch with many of the old friends. These were good years, filled with hobbies and family and free of the

stresses associated with his administrative career. Graham battled a variety of health problems and passed away on March 12, 2010.

Who was Graham Purchase? One's response to this question depends on one's relationship with Graham. His brother, Iain, a veterinarian and researcher in his own right, notes that even in childhood Graham was a keen observer and had an inquiring mind. Iain remembers Graham for his academic ability, brilliant research career, and as one "who kept his enthusiasm at all times, who maintained his cheerfulness through good and bad, who loved doing projects and fixing things, who enjoyed the social side of life, who had an abiding Christian faith but above all centered his life around family and friends."

According to Graham's son, Ken, his father had a passion for everything and made the scientific method a personal mantra in life. He saw his father as a teacher and a mentor, and devoted to his family. Ken remembers Graham as private and introverted, but also as able to have fun and to be occasionally eccentric.

Graham reflected on himself in the "Conversations" book by Stalheim. The question was "how do you view yourself when given a responsibility in research or administration?" Graham's reply was "Characteristically, I am aggressive, vigorous, and perhaps impatient. I think research must be done properly....."

Although he was universally respected for his scientific and intellectual skills, some of Graham's professional colleagues viewed Graham as sometimes lacking in sensitivity or diplomacy (mentioned earlier). He was known for his blunt criticism. Although not invariably true, enough persons found working with Graham on committees and projects to be difficult that he acquired a reputation to this effect. I believe that at some level Graham understood and was probably distressed by these concerns which were never intended outcomes.

History will correctly focus on the many exceptional contributions Graham made in his lifetime through his professional career, his community and his family. He was truly a brilliant and extraordinary scientist and a quality person. He has left a legacy that will inspire those that follow.

Biography solicited by the Committee on the History of Avian Medicine, American Association of Avian Pathologists.

Nancy Purchase and Iain Purchase provided documents, photos, and much of the underlying information for this biography, as well as a critical review of the completed biography. This project could not have been done without their help.

Additional biographical materials may be available from the AAAP Historical Archives located at Iowa State University. Contact information is as follows:

Special Collections Dept. & University Archives

403 Parks Library

Iowa State University

Ames, IA 50011-2140

Phone: (515) 294-6648

Fax: (515) 294-5525

WWW: <http://www.lib.iastate.edu/spcl/index.html>