

Veterinary radiology—History, purpose, current status and future expectations

Dear Editor,

As long-term diplomates of the American College of Veterinary Radiology, concerns for the future of the American College of Veterinary Radiology exist and we feel that both historical and future expectations of the American College of Veterinary Radiology should be so stated. The genesis of the American College of Veterinary Radiology was in chilly Chicago during an annual meeting of the Radiology Society of North America in November 1957. Attendees included a few veterinary school faculties, a veterinarian from MSPCA's Angell Memorial Animal Hospital in Boston, and several curious physician radiologists. The Radiology Society of North America provided the meeting room and collectively the group discussed strategies to organize and develop a training program and examination process leading to board certification. From this meeting, the Educators of Veterinary Radiological Sciences was formed with the objective of developing a specialty board in veterinary radiology. This effort was successful and in 1962, the AVMA recognized the American Board of Veterinary Radiology. The American Board of Veterinary Radiology changed its name to the American College of Veterinary Radiology in 1969. The Educators of Veterinary Radiological Sciences disbanded in 1973.

The American Society of Veterinary Radiology was started by three private practitioners including Myron Bernstein and Wayne Riser from Illinois and Julius Fishler from Indiana. Their objective was to provide radiology education to private practitioners with training in both technic and interpretation. The first meeting of the American Society of Veterinary Radiology was held at Fishler's home in Elkhart in 1958 including approximately 35 veterinarians who were either veterinary school faculty or interested small animal practitioners. The American Society of Veterinary Radiology had annual meetings for several years and developed programs for the AVMA, AAHA, and many state veterinary associations meetings. They continued to provide 1- or 2-day radiology programs until early 1990s. The American Society of Veterinary Radiology's name was changed to American Veterinary Radiology Society and developed a quarterly publication of veterinary radiology starting in the early 1960's with W. Harker Rhodes as editor. In the late 1970s, the American College of Veterinary Radiology adopted this journal as its official journal retaining Dr. Rhodes as editor.

A constitution of the American Board of Veterinary Radiology was written and ratified by the charter Diplomates with the following objectives:

- (1) Protecting the public against incompetence in the practice of veterinary radiology by conducting investigations and

examinations to determine the competence of voluntary candidates for certificates by the college.

- (2) Conferring certifications upon candidates who have successfully demonstrated their proficiencies in the field of veterinary radiology.
- (3) Encouraging the development of teaching personnel and training facilities in veterinary radiology.
- (4) Aiding in the evaluation of residencies and fellowships in the field of veterinary radiology under overview of the Council of Education of the AVMA.
- (5) Advising veterinarians desiring certification in the field of veterinary radiology as to the course of study and training to be pursued.

1 | CHARTER DIPLOMATES:

The original organizers included:

Gerry Schnelle (UP, 1926)	Angell Memorial Animal Hospital
Mac Emmerson (ISU, 1925)	Iowa State University
W. Harker Rhodes (UP, 1955)	University of Pennsylvania
William D. Carlson (CSU, 1948)	Colorado State University
William C. Banks (TEX, 1941)	Texas A&M

These organizers determined who would become Charter Members and who would have to become an American Board of Veterinary Radiology member by examination. Those selected to be charter members included:

Theodore J. Hage (CAL, 1954)	University of California at Davis
Dragutan Maksic (YUG, 1950)	University of Illinois
A.J. Cawley (ONT, 1954)	Ontario Veterinary College
John P. Manning (KSU, 1951)	University of Illinois
Francis A. Spurrell (MN, 1952)	University of Minnesota
Myron Thom (WSU, 1929)	Pasadena, California

2 | WHAT IS THE PURPOSE OF A RADIOLOGIST?

The purpose of a radiologist is to be a consultant and an advisor in the selection, procurement, and interpretation of imaging modalities and techniques that directly aid in the practice of veterinary medicine.

Imaging helps in the diagnosis of diseases and conditions and also helps follow effective treatment and determine prognosis. To be trusted and respected by referring clinician and other specialists, a radiologist must be available, intuitive, helpful, logical, and accurate. Making a definitive diagnosis is always the goal, but adding helpful information to the equation of clinical diagnoses is equally desirable. A radiologist should be well versed, knowledgeable, and experienced not only with imaging procedures but also with general medicine, surgery, anatomy, and pathology.

3 | HISTORY OF TRAINING AND EDUCATION IN RADIOLOGY

Prior to the development of formal residency programs, veterinary radiologists had to be creative in obtaining knowledge, training, and experience by using many different resources. Some affiliated themselves with MD radiologists in practice or at a teaching hospital. Others participated in MD radiology residency programs and others learned radiology on their own. These pioneers often learned by making mistakes and sharing experiences with others at their annual meetings in Chicago or Indiana. When in Chicago, the meeting was held during the same time as the Radiology Society of North America meeting, which provided a venue for veterinarians to see, learn, and grow from the research and knowledge provided by physicians at that meeting.

Organized residency programs were developed at some institutions in the late 1960s and early 1970s. At the same time, residencies in other specialties, such as medicine and surgery, were just beginning, which further supported the radiology residents in training.

Up until the 1970s, the radiology departments of most veterinary schools were fairly basic, with many schools having small X-ray machines. In the 1950s, some schools had 10–30 mA X-ray machines, often as military surplus. Note that 300 mA machines became more popular in the 1970s in schools and in practices. Some facilities procured larger X-ray machines, usually donated from human hospitals. Special procedures were performed, using both negative and positive contrast agents to perform contrast studies such as pneumocystography, GI studies, urography, myelography, and angiography. Fluoroscopy was available as direct visualization fluoroscopy; image intensification was just being developed.

4 | VETERINARY PRACTICE AND SPECIALTY COLLEGES

Prior to 1930, veterinary medicine was really just “barnyard medicine,” with most of the clinical studies directed toward cattle and horses and with minimal time dedicated to small animals. The diagnoses and therapies of the day were largely anecdotal, symptomatic, and empirical. As horses were becoming antiquated, a surging interest in small animal medicine began in the 30s and faculty members began taking a greater interest in small animal medicine. The number of small animal practices

in the United States quickly grew as the new graduates entered private practice.

The specialty colleges were developed for the purpose of providing organized post graduate training opportunities with a method of certification by examination. This resulted in research, with the discovery of many diseases and conditions of animals and subsequent improvement in diagnosis and management. The first AVMA recognized specialty organization was pathology and the American College of Veterinary Pathologists was started in 1951. Other than radiology and pathology, the other clinical specialty colleges did not come into being until the late 1960s and the 1970s. Others continued to develop after that time. Specialists and specialization were eagerly accepted into veterinary medicine such that by 1980, all American veterinary schools had faculty with specialty training and/or board certification.

The first referral only multispecialty practice was the Berkeley Veterinary Medical Group in 1971 in Berkeley, California. The original staff consisted of: Drs. Seymour Roberts DACVO in ophthalmology, James Ticer DACVR in radiology, S. Gary Brown ACVS in surgery, Stephen Ettinger in internal medicine and cardiology, and Ben Baker in dermatology. The specialty colleges of internal medicine and dermatology did not yet exist. Other specialists later joined the Berkeley Veterinary Medical Group, but the business was not profitable and closed in 1977. Less than 10 years later, Drs. Ralph Barrett ACVIM and Randy Scagliotti ACVO started the Sacramento Animal Medical Group. This hospital included a general practice, a specialty practice, and an emergency clinic. They purchased additional clinics in the area that served as feeder clinics to the main hospital. The central model was successful.

The 1980s and 1990s brought more specialties into veterinary medicine in academia and in private practice. There are now 32 specialties and 22 specialty colleges. There are now over 13,000 board certified specialists in the United States, as compared to less than 200 in 1970.

5 | WHAT MAKES A GOOD CLINICAL RADIOLOGIST?

A good clinical radiologist must have a solid foundation in medicine, surgery, and pathology. This is most easily obtained by completing a general internship or being employed in a multi-doctor practice before starting a radiology residency. In the clinic, a radiologist must be able to discuss with the attending veterinarians what the clinical problems and questions are, and then determine the most appropriate imaging modality to answer the question or solve the problem, by thinking clearly and be both practical and realistic. According to Peter F. Suter, “A good radiologist should be a clinician first and a radiologist second.”

A radiologist associated within a specialty clinic is an integral part of the “medical wheel” and, if effective, will elevate the level of diagnostic accuracy and be an active participant in providing quality medical care. Working with specialists in surgery and medicine who have mutual respect promotes quality professional interaction between them, thereby providing thorough and complete veterinary care. Being on site and available is the best arrangement for contemporaneous consult rather than resorting to a telemedicine consult alone. Granted,

this is not always possible except at university teaching hospitals and large private practices that employ their own radiologist.

An experienced radiologist provides experience and knowledge when dealing with individual cases, and provides second opinions when choosing imaging modalities, surgical intervention, and the need and timing for follow-up assessment. Pertinent and helpful advice should be given when choosing a radiographic contrast examination, such as an urethrogram, excretory urogram, upper GI study, or advanced cross-sectional imaging modality to aid in diagnosis. The image acquisition is best supervised by a radiologist. Obtaining the most appropriate radiographic views with the least amount of technical artifact is improved when a radiologist is nearby. You do not have to be right all of the time nor do you have to be the leader all the time. However, you must be willing to lead and be right most of the time. The adage *"Good judgment come from experience and a lot of that comes from bad judgments."* Will Rogers.

The growth and maturation of a radiologist is dependent on personality, attitude, drive, and commitment both in training and continued learning and advancement. As a practicing radiologist, it is helpful to be congenial with other specialists and supportive of each other. Follow-up assessments and an accurate diagnosis are necessary if the truth is desired, which should always be the goal. Seeing unusual pathology on a radiograph or an ultrasound image without a final diagnosis is only an "interesting finding," but without proof, it is no more than that. It is essential to obtain a definitive diagnosis via surgery, biopsy, or by pathology with gross and histological findings available. This is important to apply to subsequent cases that may appear similar. As one collects cases for presentation during their career, it is vital to have an accurate diagnosis on each case. Cases collected during a residency will always be "special" and part of one's own library and will likely be shared through future presentations and speaking engagements.

Within specialty hospitals, however, there are expected turf wars over diagnostic procedures that can alter the dynamics of those cooperative specialists. Competition for radiology, ultrasound, and the methods of fee-sharing for CT and MRI are issues that face private radiologists. Many internists want to do their own ultrasound examinations. By doing it themselves, they feel they have an instant answer and generate exclusive income, while referring that patient to a radiologist will not be instantaneous and income would be less. Nonetheless, it is recognized that some internists are better sonographers than radiologists, especially for certain types of procedures. However, many non-American College of Veterinary Radiology specialists often do an incomplete examination generating conclusions based on their clinical impressions and other data, rather than the sonographic findings by themselves. A cardiologist is more likely to be better than a radiologist for evaluating a congenital heart defect. A neurologist may be better than a radiologist in interpreting an MRI, an ophthalmologist may be better in evaluating an orbital ultrasound examination, and a dentist may be better when evaluating dentition. So, where does that leave the radiologist? An experienced radiologist is usually better at assimilating imaging data and arriving at important diagnostic conclusions as they do not have as much bias as those specialists working on their own cases.

6 | CURRENT RESIDENCY PROGRAMS

1. Many radiology residents today have had little, if any, clinical experience as a veterinarian prior to their residency. This is a grave error. A diagnostic radiologist greatly benefits from having experience as a clinician, working with animal owners, clinicians of various specialties, and participating in all phases of clinical practice. A radiologist should not be trained just to be an image reader. This may affect their clinical skills as a radiologist, their interaction with referring or collaborating clinicians, and most importantly, the patients and their owners.
2. Some residency programs are designed with the major end-goal to pass the board examination. As many newly certified diplomates take jobs in teleradiology, there may be a push during residency training to be trained with that goal in mind. This is highly questionable as the best way to train a resident. This does not produce a balanced radiologist.
3. Some residencies are coupled with graduate programs and research projects or some scholarly activity are often part of a resident's program. Residents benefit from exposure and experience to clinical research. During residency, time should be allowed for a supervised research project that results in a formal presentation as well as a scientific publication. This may encourage some residents to pursue an academic career.
4. Residents should be carefully and thoroughly mentored during their program by advisors who enjoy teaching. Reports generated by residents should be reviewed by faculty before being finalized. Sadly, many residents are left on their own with little, if any, supervision or backup, as the mentor may be busy doing committee work or be involved in their own research project. A resident should be gradually given more responsibility and independence and should not be left to be on his/her own very often. Frequent known case rounds in radiology and in regular discussions of active clinical cases are essential for a resident's development.
5. Residents should be taught how to think, deduce, and deduct information to arrive at a diagnosis or diagnostic plan. They should not just "read the images" and describe normal anatomy or to list 10 different causes of hepatomegaly and feel that they have done a good job. They also should not be spoon fed as independent thinking, reading, and the analysis associated with research are essential to provide the basis for building confidence and competence in radiology. Taking risks and being creative is important. In addition, seeking case follow-ups searching for a definitive diagnosis is imperative if a resident really wishes to learn. An interesting case without an accurate answer is only that an interesting observation. A resident should be enthusiastic about conferring with internists and surgeons as well as attending and participating in rounds and attending pathological dissections, in the necropsy room. An accurate final diagnosis is essential for a resident to learn. In a science, a resident in training should be curious and be eager to discover new things and to think "outside the box." This promotes individual creativity and discovery, not just memorizing what has been published. In addition, having that resident contribute to

the scientific literature fosters his/her education as well as that of their peers. Residents should be introduced to the value of research when at an academic institution. Some of these residents may opt to stay in academia after finishing their program. It goes without saying that there is a need for academic radiologists as well as private practicing radiologists.

- Residents working together can learn from each other, especially when they come from differing specialty programs. This is excellent education, and the comradery between residents should prevail and will be helpful for each resident, no matter what imaging career path is pursued. Radiology residents should have daily access to pathology, including both gross and histological aspects.

7 | PRODUCING AMERICAN COLLEGE OF VETERINARY RADIOLOGY DIPLOMATES: WE WANT QUANTITY AND QUALITY

There is currently a deficiency in the number of American College of Veterinary Radiology Diplomates to service both academic and practice sectors. More Diplomates need to be certified to help fill this void and the American College of Veterinary Radiology should direct, lead, and orchestrate this charge. This could be done by:

- Increasing the number of residency programs.
- Increasing the number of residents-in-training.
- Instituting alternative pathways for a residency besides the formal accredited American College of Veterinary Radiology residency.

This current deficiency was anticipated more than 20 years ago, and yet the American College of Veterinary Radiology was not effective in preventing the problem that we have today. No clear-cut solutions were apparent. Now it has come to the forefront with concerns and fears from the veterinary institutions, residency directors, and the Diplomates themselves. The academic deficiency will be progressively more severe as current academicians retire and most newly certified Diplomates are opting for private and corporate practice rather than academia.

There are several AVMA-accredited veterinary schools that do not have any full-time board-certified radiologists on their clinical faculties. Currently, these include University of Illinois, Michigan State University, St. George University, Ross University, Western Health Sciences in Southern California, Midwestern University in Arizona, Western University in Calgary, Canada, and Lincoln Memorial University in Tennessee. The proposed new schools at Texas Tech University, Long Island University, and the University of Arizona will not likely have full-time radiologists on faculty.

In addition, many academic programs are inadequately staffed with radiologists leading to less than optimal resident training, clinical service, and radiologist burn out. The American College of Veterinary Radiology will have to address this in conjunction with senior collegiate administrators (possibly the American Association of Veterinary Medical Colleges or the Veterinary Medicine Dean's Council) to resolve

salary and workload issues to provide a satisfying training and productive academic career environment. Our specialty must be preserved!

8 | FUTURE EXPECTATIONS: TELERADIOLOGY AND TELEMEDICINE

Digital radiology has been a godsend providing an affordable and rapid acquisition of diagnostic images with both less radiation exposure to personnel and the ability to electronically store and send those images. Hardware and software modifications over the past 30 years have made digital radiology affordable to veterinary practitioners. As the exportation of images can happen in seconds, teleradiology was naturally readily accepted by veterinarians in practice. If a radiologist is available, an impression of the images can be made within minutes after receipt and a typed report can be generated a few minutes later. As a result, many clinicians do not even bother to evaluate their own patient's images; they just wait for the typed report from the radiologist. This is more likely in those teaching hospitals that lack an onsite radiologist.

As the clients are paying for the consult, this has been a significant income generator for both radiologists and the clinicians who request the consult and collect the marked-up fee. The caveat here is, however, that image consultation has become a "commodity" with the expectation of both "faster and cheaper" leading to focus on the timing of the delivery, perhaps at the expense of the quality of the interpretation.

The downside of this fee for service commodity approach is that primary care DVMs are acquiring images and are just sending them without taking the time to render their own initial interpretation. This leads to a progressively decreasing radiologic skill set. Instead, the consultation should be a two-way learning experience for both the primary care veterinarian as well as the radiologist. A veterinarian should still be competent to interpret radiographs, as there are times when either a radiologist is not available or the client simply cannot afford the extra consult fee.

A relationship of a clinician with a specific radiologist is of benefit, as there is more apt to be a rapport built up over time with mutual respect. A report rendered to a stranger will usually be worded differently than one provided to a person with whom the radiologist is familiar. Information exchange is also facilitated. Veterinary practices that refer all of their radiographic cases to a radiologist are to be commended. Unfortunately, there are not enough radiologists to keep up with the demand that both teleradiology and on-site consultations have placed on them. This will only escalate in the future. As a result, teleradiologists have to work quickly, just to finish the case load and are really no more than a "production radiologist" similar to working on an assembly line. There is little or no time to feel really a part of the consult, as would be the case if the radiologist was either on the clinic floor or at least familiar with the practice and veterinarian seeking the consultation. The net result is the loss of interspecialty corroboration and the decreasing importance of the radiologist as a partner in patient care as well as a comprehensive imaging expert.

Ideally, one's chosen field or occupation is one that is truly enjoyed over time, gives one enough variety to keep it interesting, and has

accolades and positive feedback to make one feel that his/her job is indeed worthwhile. Telemedicine may put professional satisfaction at risk.

9 | THE IMAGING REPORT

An imaging consultation is an important aspect of a radiologist's function and should be well written, with both a discussion of abnormal findings and a conclusion. Many radiologists include comments about suggested additional imaging examinations, follow-up studies, or other intervention, such as surgery or another diagnostic procedure like an endoscopy. The report should be devoid of typographical and clerical errors. The style of a consult varies between individuals due to training, knowledge, experience, and personality of the radiologist. The reporting style may also be dictated by the preference of the referring veterinarian.

A radiologist should stand behind his/her consult when challenged and be happy to amend the report if so requested or needed. A long report without any specific conclusions is of no value to the patient, the owner/client, or the referring doctor. A discussion of abnormal findings should be succinct and clearly stated. The differential diagnosis of conditions that could explain those abnormal findings should be ranked from most likely to least likely and be a fairly short list. Radiologists differ in their use of parts of the report whether it be categories such as findings, impressions, interpretation, discussion, comments, diagnosis, and so forth. There is no universal template available.

Commonly observed errors:

1. Too much verbiage describing normal radiographic anatomy.
2. Listing too many differential diagnoses for every abnormal finding.
3. Failure to address the reasons why the images were performed and to address the clinical problems.
4. Over-reading patterns or changes that are typical for age and breed or accentuated by digital radiography, such as a "prominent interstitial pattern."
5. Making clinical diagnoses from radiographs such as feline asthma, Cushing's Disease, or bronchitis.
6. Using macros in reports that are not relevant to the case being evaluated.
7. Poorly worded or derogatory comments about radiation safety.

10 | WHERE DO WE GO FROM HERE?

1. Be aware of the problems and challenges of veterinary medicine and the specialty of radiology.
2. Improve the quality of the approved residency programs and train better radiologists.
3. Make changes. "The way to get started is to quit talking and begin doing." Walt Disney.
4. Reaffirm the importance of radiology in veterinary medicine by working with, convincing, and proving to our specialty colleagues,

veterinary school deans, and academic faculty, that we are here to help them. If we demonstrate our competence, other specialists will value and request our services more frequently.

5. Work together:

- a. Support the American College of Veterinary Radiology, ECVDI, AAVDI, EAVDI, IVRA
 - b. Support our journal: "Veterinary Radiology & Ultrasound"
 - c. Be active within the parent organizations, committees, and workshops.
 - d. Contribute to the advancement, knowledge, and education of radiology
 - e. Consider activation of a group or committee of academic radiologists to enhance, develop, and unify in the education of veterinary students and resident training (similar to the historical Educators of Veterinary Radiological Sciences).
6. Believe in and encourage others to be involved with radiology, education, and consultations with veterinarians around the globe as: One Medicine: One Science: One World.
 7. Act as a role model to high school, preveterinary students, and veterinary students to inspire interest in veterinary medicine and the specialty of radiology.
 8. Recognize that unless radiologists step up their scholarly output, they will be considered unfit for tenured track positions in academic institutions focused on research, which effectively weakens the specialty and the opportunities for our trainees.

11 | WHAT CAN WE DO IN PLANNING FOR THE FUTURE?

1. Develop strategies to maintain quality residency training programs and to increase the number of residency positions.
2. Develop concepts on future radiological delivery of services that are clinically relevant, safe, effective, and at a reasonable cost.
3. Promote ourselves to other specialty colleges and the public at large.
4. Maintain and improve our specialty in order to remain in the forefront of diagnostic services and the scholarship of imaging that are helpful in the delivery of quality medical care to our patients and the academic credibility of the specialty.
5. Recognize trends and proactively react to changes in veterinary imaging. Respectively submitted,

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