

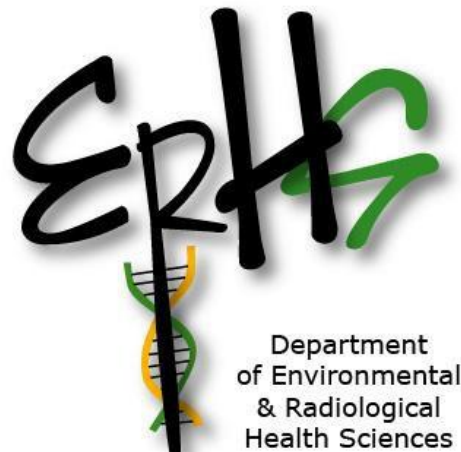
Colorado State University

COLLEGE OF VETERINARY MEDICINE
AND BIOMEDICAL SCIENCES

Veterinary Diagnostic Imaging

Radiology Residency

Requirements and Syllabus



**DEPARTMENT OF ENVIRONMENTAL AND
RADIOLOGICAL HEALTH SCIENCES**

RADIOLOGY RESIDENCY PROGRAM

1. INTRODUCTION

The Department of Environmental and Radiological Health Sciences at Colorado State University offers a combined Residency/Master's program in Veterinary Diagnostic Imaging, with the objective of meeting the eligibility requirements of the American College of Veterinary Radiology to sit for the certifying board examination. The program offers clinical training in all aspects of diagnostic imaging under the guidance of 6-8 board certified faculty radiologists. A total of three to six residents are typically being trained at any one time (1-2 starting the program each year). The radiology faculty has imaging expertise which encompasses large and small animal radiology, ultrasound, nuclear medicine, computed tomography, and magnetic resonance imaging.

The residency is a three year program combined with a Master's degree that typically begins in July. The Master's degree is earned in conjunction with the residency by completing a non-thesis graduate program of study. This program consists of 36 hours of graduate coursework, completion of a research project, and successfully passing a final oral graduate examination. Results of these research projects are to be presented during resident seminars at CSU, presented at the annual ACVR scientific meeting and a manuscript submitted for publication to an appropriate national or international journal. Residents will also gain teaching experience through clinical teaching sessions with veterinary students.

A stipend is provided, tuition and fees are paid, and two weeks of vacation per year are allowed. Residents receive sick leave and health benefits.

II. Objectives

The residency training program is designed to provide supervised training in diagnostic imaging in an atmosphere conducive to learning clinical diagnostic imaging with an introduction to clinical investigation. The residency is also designed to prepare the trainee for certification by the American College of Veterinary Radiology. The residency is designed to provide thorough training in small and large animal radiology and ultrasound. More limited training is also provided in nuclear scintigraphy, computed tomography, and magnetic resonance imaging.

III. Training Period

The residency program requires 3 years (36 months) of training in veterinary diagnostic imaging of which at least 30 months is supervised clinical experience. See Appendix B for a schedule of clinical experience.

IV. Direction and Supervision

The program director has a 70-75% commitment to the diagnostic imaging service and is involved in clinical instruction to residents as well as resident rounds, journal club, and known case conference. ACVR Diplomates are assigned to diagnostic radiology, ultrasound, nuclear medicine, CT, and MRI services at all times.

V. Faculty

The following faculty are involved in the residency training program.

Head, Department of Environmental and
Radiological Health Sciences

J. Nickoloff, PhD

Residency Director

L. Zekas, DVM, Diplomate ACVR

Faculty Radiologists

S. Adams, DVM, Diplomate ACVR, M.S.

L. Griffin, DVM, Diplomate ACVR (RO), M.S.

L. Lang, DVM, Diplomate ACVR, M.S.

A. Marolf, DVM, Diplomate ACVR

E. Randall, DVM, Diplomate ACVR, M.S.

M. Barrett, DVM, Diplomate ACVR, M.S.

L. Zekas, DVM, Diplomate ACVR

Faculty Emeritus

R. Park, DVM, Diplomate ACVR, PhD

S. Kraft, DVM, Diplomate ACVR, PhD

Formal teaching of didactic lectures to professional veterinary students and graduate students are distributed equally among faculty. Radiology resident/graduate research projects are supervised primarily by one selected radiology faculty member, but other radiologists serve on the graduate committee and thus play a supervisory role as well.

Diagnostic imaging faculty share clinical rotations and resident lectures, clinical case rounds, known case conference rounds, and average 50-75% time on clinical duty, 20-35% time teaching and 0-15% time research.

Specialists in Veterinary Teaching Hospital include:

American College of Veterinary Radiology	7
American College of Veterinary Internal Medicine	20
American College of Veterinary Theriogenology	5
American College of Veterinary Surgery	17
American College of Veterinary Ophthalmology	2
American College of Veterinary Anesthesiology	4
American Association of Zoological Medicine	2
American College of Veterinary Emergency Critical Care	2
American College of Veterinary Pathology	12

VI. Affiliation Agreement

The residency program does not require affiliations with other institutions or training programs.

VII. Facilities

The facilities at the CSU Veterinary Teaching Hospital reflect state-of-the-art diagnostic imaging. The diagnostic imaging department is completely filmless and digital with a web-based Radiology Information System (RIS) and PACS system (iSite Phillips). Diagnostic imaging has the following assigned rooms:

Radiology:

Large Animal	2 Examination rooms
Small Animal	3 Examinations rooms
Ultrasound	3 Examination rooms
CT	1 Examination room, 1 control room, and 2 equipment rooms
MRI	1 Examination room, 1 control room, 1 reading room and 1 equipment room
Nuclear Medicine	2 Rooms Diagnostic, 2 wards, 1 radiopharmaceutical lab
I-131 Facility	1 ward, 1 ante-room

Small Animal Room:Siemens 1-800-767-2313(Aug 2007)

800 mA Siemens Multix Top/Vertex Solitaire machine, with four way float top elevator table, Eklin RadipStart Clinical Digital Radiography System.

Small animal Radiography/fluoroscopy

800 mA multi-pulse high voltage waveform generator
Siemens Polydoros SX 65 generator with 150 kV X-ray tube
Siemens Sireskop CX ceiling free spot film device and permanently attached digital PC based imaging chain with tilting and floating table top. The spot film device has a front loading cassette arrangement with automatically programmed field subdivision.
An overhead suspended X-ray tube of 1509 kV capacity can interlock with a fine bucky grid.
Three photocells are available in the cassette holder to calculate and to terminate the exposures at a predetermined film density.

Small animal Radiography/fluoroscopy Room:

Toshiba KXD-80F, 800 mA, 180 KW, microprocessor controlled generator
Ceiling free spot film device and permanently attached image
Intensifier television chain with a tilting and floating table top. The spot film device has a front loading cassette arrangement with automatically programmed field subdivision
An overhead suspended X-ray tube of 150 kV capacity interlocking capability with a fine bucky grid. Eklin RadieStart Clinical Digital Radiography System.
Fluoroscopy is incorporated with a digital imaging system (Infimed) Platinum RF fluoroscopic imaging computer.
TIMS live video recorder and CD/DVD burner.

Dicom Compliance achieved with addon TIMS and Infimed units

Small Animal Special Procedure Room:Siemens 1-800-767-2313

Seimens Polydoros 805-80 KW generator
Camera mounted on a C (arcoscope arm) for fluoroscopy examinations and image intensification, and digital imaging X-ray tube mounted on a telescopic ceiling suspended crane for magnification studies
One pressure injector: Liebel-Flarsheim Angiomat 3000
Koordinate Kombi table with floating top
Fluoroscopy is incorporated with a (Infimed) Platinum One DSA digital system.
TIMS live video recorder and CD/DVD burner.

Large Animal Examination Room: Philips 1-800-722-9377

Two overhead ceiling-suspended longitudinal and transverse rail systems to support three telescoping cranes for high powered Philips X-ray tubes and a catapult bucky grid with interlocking capability at set distances and move as a unit or independently.
Eklin EDR3 Clinical Digital Radiography System with Cesium Iodide 17x17 active capture panel.
High powered ultra high heat capacity Philips X-ray tubes
Philips Super CP 100-100 kw generator
Dell Medical/Simon DR 400MA/125KVP system

In addition:

Two Minray 80+port with Eklin Mark III Digital System

Updated 8/2016

Ultrasound Room:

Toshiba Aplio 500 (x2)
GE Logiq 9

AGFA CR imaging plates for remaining rooms

Computer Tomography/PET

Philips PET/CT
Extended Brilliance workstation

Magnetic Resonance

GE 1.5 Tesla 9.0 LX MRI scanner with Multinuclear spectroscopy
Advantage Windows workstation

Nuclear Medicine:

Digital Omega Gamma Camera with Mirage Acquisition/Processing Station for large animal.

Dicom compliance

GE Millenium SPECT system for small animal planar, whole body and SPECT imaging

VIII. Clinical Resources

The diagnostic imaging service at the CSU VTH sees approximately 8,000 small animal radiology cases and 2,800 large animal radiology examinations per year, including exotic animals and food animal patients. Approximately 1,700 ultrasound, 300 CT, 450 MRI, 360 diagnostic nuclear medicine, and 60 I-131 cases are performed annually. The exotic animal service at the CSU VTH is run by 2 full time clinicians. The Rocky Mountain Raptor program is included in the exotic service. The food animal program includes dairy, beef, and camelids. The equine and small animal clinics at the CSU VTH are staffed by a full complement of surgeons and other medical specialists.

DETAILED PLAN OF TRAINING YEARLY CASELOAD

The average case load and resident case experience are as follows:

	Cases per year	Case load over 30 months for 3 residents	Case load over 30 months for single resident
Radiology Small Animal	8,000	18,750	6,250
Radiology Large Animal	2,800	6,250	2,084

	Cases per year	1 Year/Resident	Case load over 30 months for single resident
Ultrasound	3500	3500	8700

	Cases per year	4 Months/Resident	Case load over 30 months for single resident
Computed Tomography	700	230	1700
Magnetic Resonance Imaging	300	100	700
Nuclear Medicine (diagnostic)	300	100	750

Residents are assigned to diagnostic radiology for at least 12 months, ultrasound for 6 months, nuclear medicine for 2 months, CT/MRI for 4 months, LA imaging specific for 2 months and an elective rotation for 4 months. Rotation duties may overlap; for example, a resident might be on CT/MR and radiology simultaneously.

Approximately 120 food animal cases (bovine, ovine, caprine, and camelids) are seen per year. In the small animal diagnostic radiology rotation, about 300 exotic animal species are radiographed. Eighty percent of these (exotic species) are avian (mostly raptors). The balance is evenly divided between reptiles and exotic mammal species.

IX. Training Content

Clinical training: Residents have clinical rotations in diagnostic radiology and ancillary imaging areas. Under supervision of an assigned radiologist, residents work with and dictate cases on a daily basis. All reports are reviewed and corrected with the supervising radiologist. Select cases are presented in a rounds format for discussion 4 days a week. Residents also have night and weekend radiology emergency duty during their training. This is shared equally among the residents.

Clinical radiology rounds: Residents will attend radiology rounds 4 mornings a week. Other imaging related discussion sessions are held weekly, alternatively between Known Case Conference (oral boards prep) and Journal Club. Assignments will be made to residents for participation in Known Case Conferences and Journal Club. Residents are encouraged to attend pathology rounds each week when possible. Radiographs may be

presented by the resident at these rounds. Other medical, surgical and grand rounds within the VTH are available and should be attended when the schedule allows.

Didactic classes: Residents enroll in graduate school during the course of their residency program. A plan B (non-thesis) MS degree is offered. Residents in training programs pursuing an MS degree are required to enroll in a plan B program and to meet the minimum credit hour requirement listed below. Should an individual begin the combined resident/MS program and decide not to complete the residency, 36 credit hours would still be required to fulfill the MS requirements

A resident with a pre-existing MS degree, may request not to pursue the MS degree. Permission may be granted at the discretion of the radiology faculty. The resident must notify their advisor/committee. In such cases where permission is granted, the resident will register for the minimum credit requirements to complete the outlined Residency Training Program approved by the American College of Veterinary Radiology.

Clinical teaching responsibilities: Residents participate in teaching diagnostic imaging to third and fourth year veterinary students. Presentation of at least 1 didactic lecture or seminar and participation in continuing education courses and/or anatomy instruction is also expected.

The following core graduate courses are required:

<i>Course #</i>	<i>Credits</i>	<i>Course name</i>
ST307	3	Statistics or equivalent (only needed if no other statistics course has been taken)
ERHS550	5	Principles of Radiation Biology
ERHS701	4	Advanced Diagnostic Imaging Modalities (offered in odd years Spring semester)
ERHS711	4	Advanced Radiographic Interpretation (offered in even years Spring semester)
ERHS712	3	Medical Imaging Physics
VS792	1	Seminar/Graduate

The following Elective Courses are available including independent study credits in the various modalities. These credits will complete the required 36 credits for the MS degree:

<i>Course #</i>	<i>Credits</i>	<i>Course name</i>
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ERHS721	(1-3)	Radiation Oncology
ERHS795A-K	Varied	Independent Study
ERHS770	(1-3)	Radiation Biology Basic to Tumor Therapy
VS 670	3	Cardiology
VS701-704	Varied	Postgraduate Medicine I-IV (requires Residency Director approval)

The clinical imaging duties will comprise at least 30 months of the 36 month residency program. Off clinic time will be approximately distributed as follows: 3 weeks in the first year, 6 weeks in the second year and 9 weeks in the third year. Off clinic time is spent on clinical investigation projects, board exam preparation, conference attendance etc. Residents are allowed 10 days of vacation per year. Vacation time is considered in your off clinic time allotment.

X. Research Environment

A prospective or high quality retrospective research project is required. Possible topics for a project should be discussed with your research advisor. A proposal for your project should be developed and presented by the winter/early spring of your 1st year. Research projects must be reviewed and approved by the resident's advisor and graduate committee. A faculty person must be chosen by the resident to be a primary consultant on each investigational project. The results of these investigational projects will be presented in the Graduate Seminar Course, and one project should be presented at the annual ACVR meeting and CVMBS research day. Application for any research money must be made to the appropriate funding agency through the faculty consultant who assumes responsibility for performance of the work.

XI. Education Environment

An education environment is fostered in the training program. The residency program is combined with a Master's Degree. Courses required and the educational environment is detailed in the description of the training program.

XII. Evaluation

Residents will meet with the Radiology faculty and/or the director of the resident program every 6 months- a formal evaluation will occur in the winter and a more informal in the spring/summer (or more often if needed). At the annual reviews, the following will be discussed:

- Faculty evaluations of the resident's performance to date.
- Progress toward research and publication completion.

If progress towards completion of the Master's degree/Residency Program is deemed unsatisfactory by the Radiology faculty, a statement to this effect, including reasons for the unsatisfactory evaluation and suggested methods for correction of deficits will be provided to the resident, the resident's advisor, graduate committee, and to the Department Head. Deficiencies must be corrected within 3 months of the date of the statement of unsatisfactory progress. If deficiencies are not corrected, a recommendation to terminate the resident's program will be made.

Periodic Examinations/Evaluations

Written Mock Board examinations will be available during the course of the Residency to assist in preparation for the Certifying examination in September of the 2nd year.

Graduate School

Examinations for the completion of the Master's program are determined by the Colorado State University Graduate School. Successful completion of the entire combined Residency/Master's program will fulfill the eligibility for examination by the American College of Veterinary Radiology. However, it must be re-emphasized that completion of anything short of the full three-year program (36 months) will prevent the resident from being credited with having completed an approved program.

XIII. Teaching File

Radiology, ultrasound, CT, MR, and nuclear medicine cases are available for resident training. These teaching files are kept current and updated regularly with material from the known case conference rounds. These contributions are provided by the supervising faculty radiologists (who share KCC responsibilities equally) and by the residents who have rotating duties towards finding KCC cases.

There is also a file of articles compiled for reading that are selected to assist knowledge of the ACVR objective list. This is kept up to date by the residents who contribute articles to the file.

XIV. Conferences

The results of the investigational project will be presented at the annual ACVR meeting (or other appropriate meeting) and CVMBS research day. Each resident will attend one ACVR meeting to present their research projects, typically in the 3rd year of the program. Radiology resident rounds are conducted daily. Known case conference and journal club are held weekly. Pathology rounds are available and held weekly. Clinical seminars are presented weekly for all clinical faculty and residents in the veterinary teaching hospital.

XV. Literature Resources

The Colorado State University Clinical Sciences Library is situated in the VTH building. This library is well stocked with books and journals covering both veterinary and human medicine. The radiology department has an updated library located in the radiology reading area with the most commonly needed references. The main library on campus (1 mile north of the VTH) is also available. Internet access is available in the VTH with access to database searches and electronic copies of journal articles. A journal article archive for radiology residents is also available at the VTH. This archive has been compiled and maintained by previous and current radiology residents.