



## **EQUINE DIAGNOSTIC IMAGING 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-Equine Diagnostic Imaging to sit for the certifying board examination. The program offers clinical training in all aspects of equine diagnostic imaging under the guidance of 2 faculty radiologists who are founding members of ACVR-EDI. A total of 1-2 residents will be trained at a time. The radiology faculty has imaging expertise in radiology, ultrasound, nuclear medicine, computed tomography, and magnetic resonance imaging. 4 ACVR faculty radiologists practicing in small animal radiology are also on site and will provide guidance as well.

The residency is a three year program combined with a Master's degree that typically begins July 15. 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 by presenting at least 3 presentations/seminars, but also more extensively through less formal clinical teaching sessions with veterinary students. A stipend is provided, tuition and fees are paid, and two weeks of vacation per year are allowed.

### **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-EDI. The residency is designed to provide thorough training in all facets of equine diagnostic imaging with exposure to complementary training including small animal radiology, equine sports medicine, surgery, medicine, pathology and cardiology.

### **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 > 50% 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-EDI Founding members/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.

Residency Director

M. Barrett, DVM, Diplomate ACVR, DVM, Diplomate ACVR-EDI

Faculty Radiologists

K. Selberg, DVM Diplomate ACVR, MS, Founding member ACVR-EDI

Faculty Emeritus

R. Park, DVM, Diplomate ACVR, PhD, Founding member ACVR-EDI

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% time on clinical duty, 35% time teaching and service and 15% time research.

Specialists in Veterinary Teaching Hospital include:

American College of Veterinary Radiology	6
American College of Veterinary Internal Medicine	19
American College of Veterinary Theriogenology	5
American College of Veterinary Surgery	17
American College of Veterinary Ophthalmology	2

American College of Veterinary Anesthesiology	6
American Association of Zoological Medicine	2
American College of Veterinary Emergency Critical Care	2
American College of Veterinary Pathology	15

## **VI. Affiliation Agreement**

The residency program does not require affiliations with other institutions or training programs. However, the resident will be provided the opportunity for outside rotations with other experts in equine diagnostic imaging for greater breadth of training and caseload.

## **VII. Facilities**

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

Veterinary teaching hospital:

Large Animal Radiology: 1 Examination room  
 Equine Ultrasound 1 Examination room  
 CT (helical) 1 Examination room, 1 control room  
 CT (cone beam) Moveable location  
 Equine Nuclear Medicine 1 Room Diagnostic, 1 radiopharmaceutical lab

Translational Medicine Institute (immediately adjacent to hospital):

CT (helical) 1 Examination room, shared control/reading room

MRI 1 Examination room, shared control/reading room

Equine Radiology: 1 Examination room

Equine Ultrasound 1 Examination room

### **Equipment:**

#### **Large Animal Radiography**

One overhead ceiling-suspended longitudinal and transverse rail systems to support two telescoping cranes for high powered Dunlee X-ray tube and a catapult bucky grid with interlocking capability at set distances and move as a unit or independently.

Universal Canon Digital Radiography System with Cesium Iodide 14x17 wireless active capture panel, and Cesium Iodide 11x14 wireless active capture panel.

High powered ultra high heat capacity Dunlee X-ray tube

CPI Indico 100 - 100 kw generator, 800 mA

One Minray 80+port with Eklin Mark III Digital System  
Wireless 90/20 generator (Sound)

**Ultrasound:**

Toshiba I700  
GE Logiq NextGen  
GE Logiq S8 vet

**Computer Tomography/PET**

Philips Gemini TF Big Bore 16 slice PET/CT Scanner  
Pegaso cone beam  
Siemens 64 slice Somatom Definition AS

**Magnetic Resonance**

3T Siemens Magnetom Skyra  
0.3T Esaote Grande

**Nuclear Medicine:**

Digital Omega Gamma Camera with Mirage Acquisition/Processing Station

**VIII. Clinical Resources**

The diagnostic imaging service at the CSU VTH sees approximately 2,500 large animal imaging examinations per year.

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

	Cases per year
Radiology Large Animal (vast majority equine)	1,800
Equine Ultrasound	500
Equine Computed Tomography	20
Equine Magnetic Resonance Imaging	160
Equine Nuclear Medicine	45

Residents will be responsible for covering all equine imaging modalities throughout the day and are not divided by modality type. The predominant caseload is radiography but ultrasound, nuclear medicine and advanced imaging are routine as well.

While on diagnostic radiology rotations, residents will be primarily responsible for equine diagnostic imaging but will also gain exposure to other large animals and small animal imaging through clinical experience and group rounds with general ACVR residents.

## **IX. Training Content**

*Clinical training:* Under supervision of an assigned radiologist, residents work with and generate reports daily. All reports are reviewed and corrected with the supervising radiologist. Select cases are presented in a rounds format.

*Clinical radiology rounds:* Residents will attend radiology rounds 2-3 mornings a week. One of these round time is dedicated to equine imaging and the others are small animal. Equine clinicians routinely attend equine diagnostic imaging rounds. Informal equine rounds and case discussion are held daily. Other imaging related discussion sessions are held weekly, alternatively between Known Case Conference (oral boards prep) and Journal Club. Residents will also attend equine sports medicine rounds weekly and orthopedic research rounds monthly. Pathology, 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.

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 3 didactic lectures or

seminars and participation in continuing education courses and/or anatomy instruction is also expected.

The following core graduate courses are required:

Course#	Credits	Course Name	Offered
VS 562	3	Applied Data Analysis	Fall
or STAT 307	3	Statistics	
ERHS 450	3		Spring
or ERHS 550	5	Principles of Radiation Biology	Spring
ERHS 706	2	Advanced Equine Imaging	Spring, even years
ERHS 705	4	Advanced Small Animal Imaging	Spring, odd years
ERHS 712	3	Medical Imaging Physics	Fall, odd years
VS 792	1	Seminar	

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:

Course#	Credits	Course Name	Offered
ERHS 695			
I-K, M-P	Varied	Independent Study	
VS 655	3	Echocardiography in Veterinary Medicine	

The clinical imaging duties and required rotations will comprise at least 30 months of the 36 month residency program. Off clinic time will be approximately distributed as follows: 4 weeks in the first year, 7 weeks in the second year, and 11 weeks in the third year. Off clinic time is spent on clinical investigation projects, external rotations, 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 grant or proposal for your project should be developed and presented by the winter/early spring (no later than April/May of your 1<sup>st</sup> 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/or AAEP. 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 3<sup>rd</sup> 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-EDI 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). Each resident will attend one ACVR meeting to present their research projects, typically in the 3<sup>rd</sup> year of the program. Residents are also encouraged to attend and help with imaging related CE courses held at CSU.

### **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.