

Veterinary Forensic Investigations: A Novel Introductory Forensics Course Designed for Veterinary Students Preparing to Enter General Clinical Practice

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Abstract: Forensic veterinarians contribute to investigations by providing live and postmortem animal examinations, and offering expertise on topics that include animal welfare, infectious disease, and animal environments. There are thirty-three accredited veterinary colleges within the U.S. and less than 13% offer any form of forensic training in their curricula. This article will increase awareness of developments in graduate level veterinary forensic training through description of an elective course created for a third-year veterinary curriculum. The course, Forensic Investigations, is divided into three content sections, titled offenses, laws, and actions, and uses a multimodal pedagogy that includes an experiential and community-based delivery. Key medicolegal content experts deliver community-based material. Aspects of the course, including its multimodal delivery, curricular mapping to veterinary medical competencies, cumulative student and community feedback, and lessons learned are explored.

Keywords: animal abuse, animal cruelty, graduate education, veterinary forensics

Introduction

The purpose of this article is to increase awareness of educational developments in veterinary forensics. Through description of a course designed for students in their third year of a graduate veterinary curriculum, the authors will provide context for this form of training, justification for its pedagogical approach, outcomes from the eight consecutive years the course was taught, and lessons learned.

In veterinary medicine, forensic investigation is most often incorporated into a clinician's or a pathologist's wider caseload, though there is a growing group of veterinary professionals whose entire body of work is based in forensics. Forensic veterinarians provide expertise in clinical medicine, pathology, and animal welfare via forensic physical or postmortem (necropsy) examinations. Through these activities, they ensure collection and documentation of physical and biological evidence, and participate in court proceedings, giving depositions and trial testimony. Veterinarians also provide expertise in infectious diseases and animal related environmental findings that can inform crime scene investigations (1).

Veterinary forensics is still in its infancy. Criteria around professional training is lacking and standards for forensic live animal (2) and postmortem examinations (3) have only recently been developed and published. Since the late 1990s many states have created criminal statutes outlawing animal abuse, which variably addresses

neglect, physical abuse, animal fighting, and sexual abuse. Many states in the United States now require some form of mandatory reporting of suspected animal abuse and welfare-related issues by veterinarians, and some states such as Colorado (Colorado revised statute 19-3-304), take requirements a step farther, mandating that veterinarians also report suspected child neglect or abuse. Some but not all these laws provide protection from civil liability if the report is made in good faith (4). The American Veterinary Medical Association's (AVMA) website (avma.org) has a current list of all state mandatory reporting requirements as dictated by each state's veterinary practice act.

At the time of this writing, according to the American Association of Veterinary Medical Colleges (AAVMC), there are thirty-three schools or colleges of veterinary medicine in the U.S. that are accredited, and 9 additional schools with provisional status.

(<https://www.aavmc.org/about-aavmc/our-members/listing/>). Less than 13% of these colleges are reported to offer any form of veterinary forensic science training in their curricula (5). In some instances, specific lectures and practical demonstrations have been incorporated into pre-existing classes. Elective courses such as the one discussed here have also been added to curricula, and increasing access to external rotations and on-line course work has become available. Additionally, the University of Florida offers graduate certificates and a master's degree in veterinary forensics, there is a postgraduate forensic internship offered at the American

Society for Prevention of Cruelty to Animals (ASPCA) in New York and at the University of Florida, and the Vetfolio Program through the North American Veterinary Community (NAVC) has continuing education certificates in veterinary forensic science and medicine and animal crime scene investigation. Since 2008 the International Veterinary Forensic Science Association (IVFSA) has offered an annual conference with continuing education credits for veterinarians in the forensic sciences. More national veterinary organizations such as the American College of Veterinary Pathology (ACVP), the American Board of Veterinary Practitioners (ABVP), NAVC, and AVMA are offering veterinary forensic tracks during their annual conferences. Membership in the American Academy of Forensic Sciences is also open to veterinarians, providing forensic veterinarians access to established forensics standards (5).

The breadth and intrinsically interdisciplinary nature of forensic case work exemplifies the principles of One Health. For many institutions One Health is a yet-to-be-fully-actualized approach to medicine that has gained interest and acceptance in veterinary and medical graduate curricula alike (6, 7). One Health is an approach to medicine that places the focus on the health of people and animals in their shared environments. In these settings, there has been a wide-ranging application of One Health to educational objectives from zoonotic disease awareness to demonstrating community impact and outreach (8). The addition of forensics courses into veterinary curricula will further student understanding of the complexity of shared environments and the relationships between human, animal, and environmental health.

Beyond contributing to One Health curricular goals, course work for veterinary students that provides basic skills and understanding of veterinary forensics sufficient to meet the current demands of state statutes for veterinary graduates is needed. The following describes and reviews such a course, which also provides students with an overview of the relevant applied forensic sciences and the network of agencies that play roles in this complex form of casework. The course discussed has provided a base-level understanding of forensics for individuals receiving a veterinary medical doctorate degree, which will help new veterinary graduates make sound decisions when confronted with the increasing demand for them to engage in forensic casework.

Methods

Meeting the variety of state statute mandatory reporting requirements in the United States assumes practicing veterinarians are not only aware that such requirements and laws exist, but also that veterinarians are able to recognize animal cruelty or neglect, animal fighting, and animal sexual abuse when presented with it.

Further, new veterinary graduates practicing under these laws need to understand the link between animal cruelty and human violence, know how to contact local law enforcement, and given the potential for subpoenas and requests for medical records and expert witness testimony, they need an awareness of the medicolegal community. To address these needs, Forensic Investigations, a three-credit elective course offered in the third year of a four-year veterinary program, was designed, and modified over an eight-year period with the following structure and pedagogy in mind.

Course structure, content, and assessment

The course provided three hours of content per week over a ten-week period, and student numbers were ultimately capped at eight students. The duration and credit hours conformed to pre-existing curricular standards within the Council on Education-accredited veterinary college in which the course was offered. All course learning objectives were mapped to the nine AAVMC competencies (TABLE 1).

TABLE 1 *Course learning objectives and linked veterinary medical competencies.*

Course learning objective (LO)	Linked AAVMC competency*	
LO1 Through introductory materials and scenario discussions students will: -consider and examine criminal activities involving animals. -appreciate the links between vulnerable people and animals. examine the goals of veterinary forensic investigations. – discuss the team potentially required to conduct an investigation.	3.3 4.2 8.2	
LO2 Through introductory materials and scenario discussions students will: - recall federal laws associated with forensic investigations and will understand the Animal Welfare Act of 1990. - be able to discuss the concept of mandatory reporting and requirements for veterinarians. - be able to recall, assess, and differentiate federal, state, county, city (local) laws and ordinances where animal related investigations are concerned.	8.2	
LO3 Through introductory materials and scenario discussions students	3.1	

<p>will:</p> <ul style="list-style-type: none"> - be able to recall, assess, and differentiate specific Arizona state and local laws related to animal cruelty and neglect, animal sexual abuse, animal fighting, and animal hoarding. - learn how to read and interpret key statutes. <p>Students will:</p> <ul style="list-style-type: none"> - visit a court room and discuss aspects of civil/criminal case proceedings related to one of the forms of animal cruelty. - integrate local, state, and/or federal laws applicable to prosecutions with presented testimony and will discuss these points and share their perspectives in class. 	<p>3.3 4.1 4.2 8.2</p>	
<p>LO4 Students will:</p> <ul style="list-style-type: none"> - assimilate the typical sequence of events and associated key players in animal investigations. - interpret the roles and differences between law enforcement officers and detectives, and animal control and humane officers and investigators. - define property, recall what search and seizure means, and differentiate who holds the authority in given circumstances. 	<p>6.1 8.2</p>	
<p>LO5 Students will:</p> <ul style="list-style-type: none"> - identify through example where veterinary investigations interface with social services. - weigh where humane societies and special interest groups may play a role in forensic investigations and what the typical sequence of events would look like in these instances. - through examples, weigh where and how legal representatives participate in forensic investigations. 	<p>6.1 8.2</p>	
<p>LO6 Students will:</p> <ul style="list-style-type: none"> - weigh key factors prior to embarking on forensic investigations or providing expert witness testimony; specifically, discuss and critique the qualifications and expertise needed to provide expert witness testimony and state where to go for advice on acting as an expert witness. 	<p>3.1 3.2 3.3 6.1</p>	

<p>LO7 Students will:</p> <ul style="list-style-type: none"> - recall and discuss the basic components of a forensic live and postmortem physical exam and environmental assessment, including protocol and technical review. 	<p>4.1 4.2</p>	
<p>LO8 In a laboratory format, students will:</p> <ul style="list-style-type: none"> - conduct a complete postmortem examination on a domestic or exotic species. - assemble postmortem findings into a postmortem report. (Forensic case type and species will vary.) 	<p>1.1 1.2 1.3 1.4 1.6 1.7</p>	<p>2.1 4.1 4.1 5.3 9.1 9.2</p>
<p>LO9 Students will:</p> <ul style="list-style-type: none"> - gain an experiential appreciation for forensic investigations through the Phoenix Police Department Crime Response Section. - discuss crime scene investigation through case discussion with a crime scene analyst. - through a mock crime scene exercise, assimilate course content, demonstrate evidence collection and scene investigation skills, and construct a report with map and summary. 	<p>5.3 6.1 6.2 9.1 9.2</p>	

*AAVMC competencies are 1. clinical reasoning and decision-making, 2. individual animal care and management, 3. animal population care and management, 4. public health, 5. communication, 6. collaboration, 7. professionalism and professional identity, 8. financial practice and management, 9. scholarship. Sub-competencies are identified with a decimal and are numbered, see full description at <https://www.aavmc.org/programs/cbve/>.

Student enrollment was capped to reduce the student: instructor ratio and maximize student interactions in laboratory and field exercises. The first session of the course introduced forensic investigation through case descriptions and an open discussion. A three-part syllabus and note set arranged as Offenses, Laws, and Actions was provided as reference material and as the basis for most of the written assessment content. The offenses section offered descriptive content related to forms of intentional injury, neglect, hoarding, fighting, and sexual abuse. The Laws section included descriptive federal, state, and local law content related to animal crimes, and described expert witness criteria and recommendations around providing testimony. The Actions portion of the course provided descriptive content around investigative teams, crime

scenes, evidence collection, and live and postmortem forensic examinations. The course provided a proportional amount of background material taking into consideration the extensive undergraduate science training most veterinary students have, coupled with the 2 years of veterinary training they enter the course with, and the relative lack of background or familiarity with law and law enforcement. Content delivery was multimodal and included laboratory and community-based environments for lessons around clinical forensic examinations, law, and evidence. These experiential components of the course were preceded by in-class discussions and small group exercises such as role playing and a read through of trial testimony. Concepts such as keeping testimony within one’s area of expertise, and the roles and responsibilities defense and prosecuting attorneys were first introduced and then reinforced during the trial read-through and court visit.

Assessment included attendance and participation that was mandatory for all activities and community sessions, two graded quizzes, and a cumulative final examination.

Pedagogy of engagement

Recognizing that veterinary practitioners with forensic casework must have an established network of forensic professionals to work with, the course was designed in part around experiential learning that is community-based (9). This design provided a model of faculty networking and caseload development, and intentionally identified key medicolegal content-experts who could directly deliver experiential learning in the course. Thus, the very design of the course demonstrated a key course learning objective (LO1) (TABLE 1). The course was based in Phoenix, AZ, so local legal and law-enforcement forensic professionals participated in student instruction in their area of expertise through field trips to the Arizona State Department of Public Safety Crime Laboratory and the City of Gilbert Municipal Court, and a crime scene supervisor from the Phoenix Police Department provided in-class case discussions, which were used to illustrate basic crime scene procedures and protocols. In all three sessions, the forensic analysts, lawyers, judges, and detectives that students interacted with had long standing relationships with the course faculty. The relationships between the faculty and external forensic professionals were intentionally presented and described to the students to reinforce the critical nature of establishing a professional community network. This helped students recognize the complex roles various professionals have in each forensic case, and how critical their involvement was for successful outcomes.

Two additional activities, postmortem examination of a forensics case, which was submitted through the host

institutions’ anatomic pathology service, and a mock crime scene exercise were used to teach animal examination and crime scene processing. (TABLE 2). Fundamental skills such as photography, measurement, and team organization were consistent year to year in the mock crime scene exercise, with the ‘narrative’ of the case changing annually and being based entirely or in part on actual cases that had faculty involvement. When possible, an animal crimes detective was present for the mock crime scene exercise. All course activities were followed by a debriefing that allowed students’ perspectives to be shared and areas of confusion to be clarified.

Results

Student assessment and feedback

The course was taken by a total of 65 students over 8 years with cumulative examination scores across all years ranging from 88.4-94.3, and cumulative student course evaluation scores (1, least positive to 5, most positive) ranging from 4.33 to 5 (TABLE 2).

TABLE 2 Course summary.

Year	# of students	Course Grades ¹	Student Course Eval. ²
1	7	91.2	4.81
PM Exam	canine/ neglect/ part of mock crime scene		
Mock Crime Scene	indoors/ combined with postmortem examination		
2	10	89.7	4.53
PM Exam	canine/ neglect/ part of mock crime scene		
Mock Crime Scene	indoors/ combined with postmortem examination		
3	8	88.4	4.56
PM Exam	canine/ resp. disease		
Mock Crime Scene	outdoors/ dog fighting/ detective available		
4	8	90.8	5.00
PM Exam	canine/ gunshot wound		
Mock Crime Scene	indoors/ hoarding		

5	8	89.8	5.00
PM Exam	feline/ resp. disease		
Mock Crime Scene	outdoors/ cock fighting/ detective available		
6	8	90.8	4.33
PM Exam	canine/ neglect		
Mock Crime Scene	outdoors/ gunshot		
7	8	90.4	N/A
PM Exam	reptiles/ blunt force trauma		
Mock Crime Scene	outdoors/ blood splatter		
8	8	94.3	4.78
PM Exam	feline/ gunshot wounds		
Mock Crime Scene	outdoors/ blunt force trauma		

¹ Course grades shown as an averaged percentage.

² Course survey items are 1. The course objectives were clear, 2. The course content was well organized, 3. The evaluation methods adequately sampled information I was expected to learn, 4. Overall, I rate this course highly. Mean ranks are shown. Rank scaling is 5=strongly agree, through 1=strongly disagree.

Community partners that participated in course instruction were asked: What benefit do you see in participating in the Forensics Investigations course? Their responses highlighted ways in which the course increased their engagement in the field of veterinary forensics, helped them with their forensic casework, and created avenues for research through the expanded professional network the course provided.

Practicing veterinarians who had taken the course as third-year students were asked:

1. Have you been involved with any forensics cases since you graduated? If so, please expand.
2. If you have had a forensic case, rank the Forensics Investigations Course 1-5 in terms of least (1) to most (5) helpful.
3. If you could improve the course, knowing what you do now, what would you do?

Seven of these graduate veterinarians (11%) responded to the emailed survey questions. Opinions regarding benefits of the course included helping the veterinarians to identify animal abuse, providing information on how to report animal abuse to authorities (law enforcement), and feeling prepared for actual case involvement as an examiner, at a crime scene, or in court. Two respondents became shelter veterinarians and dealt with multiple high profile animal abuse cases in practice. These respondents related their comfort and confidence with these kinds of cases to insight and training gained from the course. An additional respondent during their fourth-year large animal clinical rotation had a suspected equine sexual abuse case. This respondent described being able to articulate to the clinician on the case how to address the owner and collect forensic evidence. Student recommendations included increasing the number of field trips and providing additional real case involvement. Students also suggested attending animal abuse court cases live or being provided with links to watch them virtually. A final comment was to provide more guidance regarding obtaining employment as a forensic veterinarian and/or how to create such a position/niche within their community.

Discussion and Conclusion

The authors would argue that an experiential component is needed in an introductory veterinary forensics course to accurately provide context for veterinary students. This is because of the inherent complexity and collaborative nature of forensic casework and because of how far-removed forensic medicine is from core veterinary curricula and pre-requisites.

In veterinary medicine, forensic casework is predominantly encountered by general practitioners and by specialists in veterinary pathology and shelter medicine practice. For this reason, veterinary programs with pathology and shelter medicine training programs, including residency training, may be more likely to have the faculty, staff, clinical cases, and other resources needed to develop the kind of experiential course described.

While the tradeoffs of low instructor : student ratios are familiar to faculty and administrators operating with slim budgets and staffing shortages, the advantage of small class size is that it allows implementation of a community-based model (10-11). This approach pulled learning out of the classroom and placed it in a real-world context with actual medicolegal casework at the center of a given lesson. This immediately clarified the ‘why’ for students, and provided the motivation and relevance that instructors struggle to create in classroom settings. Working in a real-life scenario also infuses lessons with the kind of confidence-building needed by students

nearing graduation and independent clinical decision making.

Lessons learned

The community-based approach of the described course not only had positive effects on students, as previously discussed, but also had positive effects on the staff and instructors teaching the course, helping to further cement community partnerships, clarify roles, and increase communication for everyone involved. Within the university, these improved partnerships led to improved histories provided with case submissions and an overall increase in case submissions and led to collaborative research projects with community partners.

The number of students was capped at 8 after the second year the course ran with 10 students. The instructors found that student involvement in activity sessions in the spaces available, such as the crime laboratory, dropped off with the larger group. The faculty prioritized student engagement and promoting positive student perceptions recognizing that negative student perceptions in an introductory course may affect future decision making, potentially including decisions around continuing a course of study or type of practice (12-13). The enrollment cap appeared to optimize student learning, perception, and logistics.

Over the eight iterations of the course, the postmortem examination and mock crime scene topic changed annually. In the early years there was an effort to combine these activities (**TABLE 2**). The instructional benefit of combining them was in demonstrating the continuity of casework from scene through veterinary examination. The difficult logistics of this level of integration led to separation of these activities in later versions of the course.

When possible, a detective was present during the mock crime scene. This additional resource gave the faculty more opportunity to observe students, and record and document actions for the debriefing session. Having a detective present also changed student behavior, generally creating a more focused attitude during the activity. The crime scene activity was viewed by the students and instructors as the best way to highlight safety issues, develop observational skills and critical thinking, and develop and clarify team dynamics. Each year the mock crime scene was video recorded and reviewed by the class. Putting the video together took additional instructor hours, but student engagement when it was played was high, and viewing the event prompted students to self-critique and make observations that assimilated course content.

Students were provided with a large note set that was considered a living document to be modified and added to as the field of veterinary forensics grew. Students

appreciated the notes as a resource and requested reading assignments from it ahead of class discussion sessions.

The court room visit evolved from a simple tour to increasing interaction with judges and prosecutors. In the later years, an in-class session was devoted to students playing parts in a read-through of testimony from one of the instructor's court cases as preparation for the court visit. During the visit a judge and attorneys were present to call students to the stand, question them as expert witnesses in mock scenarios, and debrief with them afterward. Students consistently found this activity mildly to moderately stressful, but also consistently recommended that it remain as part of the course. Students were also asked if they would prefer being told in advance that they would be called to the stand to testify in the scenarios and they unanimously preferred that it be kept a surprise until they arrived at court.

The crime laboratory visit was run in-person with a single tour guide, in-person with multiple staff presenting in addition to a tour guide, and remotely during one year of the pandemic. The remote tour held minimal student interest and is not recommended. The in-person tours were both very well received and had good student engagement, with a bit more interaction when the staff were involved in presenting their work areas.

The postmortem examination created context and opportunity for students to develop sample collection and packaging skills while developing required curricular clinical examination skills. It provided an opportunity to address several important topics, including sample contamination, zoonosis, chain of custody, and the effects of delays on sample quality.

The area that was most criticized by students and instructors alike was the written assessment portion of the course. Question style that was confusing and content that did not align with student expectations were the most common issues for students. For instructors, questions fell short in assessing concept comprehension and skill development.

In conclusion, there is a need for veterinary forensic training within existing veterinary college curricula. Drivers of this include interest in applying One Health principles to medical practice, the recognized link between human violence and animal abuse, and state veterinary practice acts that are increasingly legislating forms of mandatory animal abuse reporting by veterinarians throughout the United States.

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