

Veterinary Pharmacy Clerkship: A Model

Elaine Lust

ABSTRACT. Pharmacy students desire education and knowledge about the use of prescription medications for the treatment of animal disease states. Information on this aspect of education within the pharmacy curriculum is lacking. While it is reasonable to expect graduates to fill some veterinary prescriptions in a community environment, the therapeutic knowledge base for this activity is absent in many curriculums. One model used to prepare graduates for practice in veterinary pharmacy is the offering of an elective veterinary pharmacy clerkship for fourth-year doctor of pharmacy students. The clerkship uses active learning strategies in veterinary-centered environments such as the Humane Society, a zoological park, an animal health distributor, and veterinary clinics to enable students to apply their human pharmacy knowledge base to diseases and conditions that are seen in animal patients. *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>> © 2003 by The Haworth Press, Inc. All rights reserved.]*

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INTRODUCTION

Growth in veterinary pharmacy at the community pharmacy level over the past ten years is evidenced by the number of practitioners offer-

Elaine Lust, R.Ph., is a Pharm.D. candidate and Instructor and Veterinary Pharmacist at Creighton University School of Pharmacy and Health Professions, Department of Pharmacy Sciences, 2500 California Plaza, Omaha, NE 68178.

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ing their services and products to veterinarians and animal owners. An Internet search using one engine for terms “veterinary and compounding and pharmacy” yielded a list of over 100 pharmacies that offer veterinary pharmacy services. New organizations supporting veterinary pharmacy in a community practice have developed, and a book offering guidance in this area has been published (1). However, from the academic perspective, documentation of educational offerings in this area is lacking. A Medline search of terms “veterinary and pharmacy and curriculum” and “veterinary and pharmacy and elective” yielded zero results (2). The terms “veterinary and pharmacy and education” yielded 14 results, but none had direct application to pharmacy curricula (2).

According to Scott Long in his article in *Community Pharmacist* on “Veterinary Therapeutics in Community Pharmacy Practice,” community pharmacists commonly receive prescription orders from veterinarians for human label pharmaceuticals that are to be used in animal patients (3). However, the exact number of veterinary prescriptions filled is difficult to assess.

Members of academia can introduce pharmacy students to the unique differences in veterinary pharmaceuticals, their indications, species dosing, and legal applications of filling veterinary prescriptions for animal patients through a clerkship in veterinary pharmacy. This clerkship model has incorporated hands-on experience in veterinary settings with active learning strategies to offer practical experience in veterinary pharmacy.

Material presented on this clerkship is an extension of the student’s human therapeutics knowledge base. For example, endocrine disorders are common in canines and felines. Hypothyroidism is one of the most commonly diagnosed endocrine disorders in canines, with levothyroxine dosages four to five times those for humans (4, 5). Insulin is the drug of choice for diabetes in canines and felines, but the dosage and duration of action of any single common insulin differ significantly between canines and felines (5). Other examples are drugs commonly used in human medicine that carry significant risks when used in veterinary medicine. For example, acetaminophen is known to have a relatively safe human side effect profile but is extremely toxic to felines (5, 6). Pharmacists and educators alike need to recognize the importance of veterinary disease state education and veterinary pharmaceutical knowledge to bridge the gap between human and veterinary medicine when dealing with animal patients.

Legal issues and concerns surrounding veterinary pharmacy must also be presented to students. Nebraska state statutes pertaining to the

practice of pharmacy require that pharmacists make a verbal offer to counsel on all new and refill prescriptions (7). Elements that should be included in the counseling are name and description of the drug, route of administration, duration of therapy, special directions or precautions, common side effects, proper storage and refill information, and action to be taken in case of a missed dose (7). Other states have similar requirements (8). Boards of pharmacy do not separate the legal requirements of verbal prescription counseling offers for human patients and for animal patients (7, 8). Consequently, practitioners may feel ill equipped to handle these types of veterinary patient care scenarios because they may not have adequate knowledge about some or all of these issues.

Education on veterinary disease states and veterinary therapeutics can help the students feel more confident when meeting the legal requirements of prescription counseling to animal owners. If students are knowledgeable on the common companion animal disease states (epileptic seizures, diabetes and hypothyroidism) and the human label drugs used to treat those conditions (phenobarbital, primidone, potassium bromide, NPH and ultralente insulin, and levothyroxine), they may be more confident in the care they are providing to their animal patients while meeting the legal requirements of patient counseling (7, 8).

This article provides information about a unique pharmacy clerkship. Each aspect of the clerkship is described to provide adequate details on the basic structure and activities of the clerkship. This type of information could be helpful to faculty who are developing clerkships or courses related to veterinary pharmacy.

PURPOSE

To prepare students for the receipt of prescriptions for animal patients, Creighton University established an elective veterinary pharmacy clerkship for fourth-year Pharm.D. students. The purpose of the veterinary pharmacy clerkship is to give students insight and practical experience in veterinary informatics, operations of animal health product distributors, veterinary compounding, exotic animal care, and the role of pharmaceuticals in the everyday practice of veterinary medicine.

Table 1 provides a correlation of the veterinary clerkship objectives to the ability-based educational outcomes for the School of Pharmacy graduates. The individual objectives that each veterinary clerkship activity supports are listed across from the educational outcomes that are expected for pharmacy graduates.

TABLE 1. Ability-Based Educational Outcomes for School of Pharmacy Graduates.

Pharmaceutical Care Abilities	Application of Veterinary Clerkship Objectives
Drug Therapy Evaluation	Students shall determine appropriate drug therapy based on species-specific pharmacokinetic parameters of canines, felines, and other companion pets. Differences in pharmacological actions of identical drugs shall be considered. Students will understand extra-label drug use and develop an appreciation of how economics can influence treatment choices in veterinary medicine.
Pharmacotherapy Decision Making	Students shall communicate with veterinarian and recommend use of human and veterinary label pharmaceuticals in companion animals where appropriate. Students shall apply known principles of the human-animal bond to human and animal patient care scenarios.
Medication Preparation and Distribution	Students shall be able to meet the legal counseling requirements for medications dispensed to animal owners. Students shall demonstrate the ability to accurately interpret and compound prescriptions from veterinarians for human label drugs used in companion animals. Students shall be able to dispense medications consistent with animal needs.
Systems Management	Students shall be familiar with the controlled substance inventory requirements and be able to advise veterinarians on record-keeping requirements.
General Education Abilities	Application of Veterinary Clerkship Objectives
Communication Skills	Students shall communicate with veterinarians, veterinary technicians, and other professionals in the animal health industry. Students shall use multimedia when educating veterinary-orientated audiences. Students shall communicate effectively with animal owners about their pet's drug therapy.
Critical Thinking	Students shall understand the need for nonlinear thinking in veterinary pharmacy and be able to resolve problems that arise with drug administration or drug therapy in companion or exotic animals.
Professional Ethics and Responsibility	Students shall represent the profession in an ethical manner. The students shall respect the economic and administrative differences that occur in veterinary medicine versus human medicine. Students shall apply ethical principles to inappropriate compounded medication requests.
Social Interaction, Citizenship, Leadership, and Professionalism	Students shall demonstrate appropriate interpersonal behaviors. Students shall provide service to the profession and community through volunteer work at the Humane Society and zoo.
Information Management	Students shall demonstrate the ability to interpret and evaluate data for the purpose of assessing the accuracy and reliability of information from veterinary reference sources.

SETTING

Two students are assigned to the veterinary clerkship for one 4-week rotation period. This elective clerkship is available eight months out of the year. Therefore, a total of 16 students may take the clerkship per

year. This clerkship format began in March 2001. Since then, 12 students have completed the rotation.

On the first day, students are given guidelines and expectations for the rotation. Additionally, the external veterinary-based sites are described, and the students are encouraged to ask questions and to provide feedback on the proposed learning experiences during this time.

Students have given numerous reasons for choosing this elective clerkship. The most frequently reported reason for choosing this rotation is simply to experience a different aspect of pharmacy. Other students hope to gain knowledge about animals that can be used in a retail setting or own an animal that has been diagnosed with a disease state.

The faculty member responsible for creating and developing this clerkship has nine years of experience in veterinary pharmacy. Her experience includes consulting for the animal health industry; educating beef cattle producers, growers, and feeders on the proper use of pharmaceuticals in beef cattle; provision of pharmacy services to companion animal practitioners; working with bovine veterinarian practitioners; and educating pharmacy students and practicing pharmacists in veterinary therapeutics. The author is also an active member of the Society of Veterinary Hospital Pharmacists and frequently presents on pharmacotherapeutics or regulatory issues pertinent to veterinary pharmacy to local, regional, and national audiences.

CLERKSHIP ACTIVITIES

Students must complete a number of required activities to meet the educational outcomes for this rotation. The activities involve exercises in seven different areas, ranging from disease state research to time spent at the local zoo. Activities at the external veterinary sites are coordinated by the instructor for each student, and the level of supervision given to each student for each learning activity has been arranged prior to the student's arrival. Following completion of each veterinary site rotation, the student is required to participate in a weekly round-table discussion with the other clerkship student and instructor. By using this method, the students are able to share their experiences and observations and to educate each other on their particular activities at each site. This discussion format also allows the instructor to assess the level of participation that the student engaged in while at the site, and compare them to the activities and observations from previous clerkship stu-

dents. A description of the seven individual clerkship activities follows. Student experiences, observations, and reflections are included.

Disease State Research

To enable the students to use veterinary informatics and apply information gained from those sources to clinical situations, each student is assigned three animal disease states and two case studies to research while on the rotation. These activities serve to educate the student on common animal disease states and on species-specific pharmacologic and pharmacokinetic parameters of drug therapeutics. Examples include canine or feline diabetes, canine hypothyroidism, equine protozoal myeloencephalitis, otitis externa, and osteoarthritis. Students research and describe the pathology, signs and symptoms, diagnosis, treatment options, and prognosis of each condition. Within the treatment sections, students are expected to detail the use of human label and veterinary label prescription pharmaceuticals. This reinforces the skills needed to suggest appropriate drug therapy for certain animal disease states. It also introduces students to the extra-label (off-label) uses of human and veterinary pharmaceuticals.

Library services at Creighton University provide the veterinary clerkship students with text references and Internet access needed to conduct a proper literature search for their disease state papers and case studies. Titles specific to veterinary medicine have been purchased for support of the clerkship and student use (Table 2). The students are also given a list of veterinary Web site addresses which the instructor knows to be reliable to assist in their on-line research (Table 3). This is beneficial to the students because, up to this point, their use of on-line resources has focused on human medicine, and they are typically unaware of the veterinary resources available. Students are required to visit each Web site and to explore the associated links. They are expected to identify and recall which site offers the most appropriate information on veterinary medicine and animal health issues. The students are graded pass/fail upon their ability to describe, discuss, and differentiate each site during weekly roundtable discussions. This exercise allows students to demonstrate their ability to interpret and use information from veterinary reference sources and supports the information management objective of the clerkship.

The students present the research papers and case studies during the third week of the clerkship. At this time, the clerkship students and the instructor discuss the disease state research in a roundtable manner, fo-

TABLE 2. Useful Veterinary Text References.

Title	Description
<i>Veterinary Drug Handbook</i> by Don Plumb*	Written by a pharmacist, this book has valuable information on extra-label dosages, indications, and specific drug information on human and veterinary label pharmaceuticals used in vet medicine.
<i>Textbook of Small Animal Medicine</i> edited by John Dunn	This reference book has information on the many diseases affecting small animals.
<i>Textbook of Veterinary Internal Medicine</i> by S.J. Ettinger and E.L. Feldman	This is a very complete reference book on internal medicine for small animals.
<i>The Merck Veterinary Manual</i> edited by Clarence Fraser*	The manual details diseases, conditions, and therapeutic treatments for small and large animals.
<i>Essentials of Small Animal Anesthesia</i> by John Thurmon et al.*	A useful reference on the labeled and extra-label use of pharmaceuticals used for anesthesia, pain control, and euthanasia in veterinary medicine
<i>Antimicrobial Therapy in Veterinary Medicine</i> edited by John F. Prescott*	A useful reference detailing drugs, dosages, and indications for infectious disease in small and large animals
<i>Compendium of Veterinary Products</i> edited by Aurora Arriola*	This book is the veterinary equivalent to the human <i>PDR</i> . It lists all prescription and OTC veterinary pharmaceuticals and biologicals currently approved for all animals—a useful reference.
<i>Journal of the American Veterinary Medical Association</i>	The official publication of the American Veterinary Medical Association. Articles are peer reviewed and have a research or clinical focus.

*Can be ordered through Iowa State University Press (<http://www.isupress.com>)

cusing on extreme differences in the pathology, symptoms, and treatment of identical diseases in human medicine. Diseases and conditions that are unique to veterinary medicine are also discussed. This format allows for the exchange of information among students and the instructor and helps prepare students for their upcoming experiences in private veterinary hospitals and clinics. Students receive a letter grade based upon the content and structure of their research papers and case studies as well as discussion participation.

Community Pharmacy

Each student spends one day at a local community pharmacy that specializes in veterinary compounding. Prior to this site visit, students are required to read the Compliance Policy Guideline on Compounding for Animals and the legislative act that directly apply to pharmaceutical use in animals (9, 10). These readings detail the legal differences and associated risks between compounding for companion animals and compounding for food animals. The Compliance Policy Guideline is-

TABLE 3. Addresses of Reliable Veterinary Web Sites.

URL	Description of the Site
http://www.fda.gov/cvm	Homepage of the FDA Center for Veterinary Medicine. This site is the best reference for legal and regulatory issues in veterinary medicine.
http://www.peteducation.com	Information on veterinary disease states and pharmaceuticals. It is written with the animal owner in mind.
http://netvet.wustl.edu	Net Vet Veterinary Resources site contains animal disease state information, information on veterinary journals, and links to vet schools.
http://www.usp.org	This site provides quality reviews, practitioner reporting, and drug information.
http://www.avma.org	This is the Web site of the American Veterinary Medical Association. Issues of interest to the profession will be found here, as well as links to public resources, allied organizations, and the table of contents to the association's journal publication.
http://www.vetmedcenter.com	Search animal disease by specialty, use the resources of the 5-Minute Veterinary Consultant (a text reference that is available on-line at this Web site), do article and subject searches. This site is written with the professional in mind and requires a login.
http://www.petplace.com	This site contains numerous articles on small and companion animals but is written with the animal owner in mind.
http://www.vet.cornell.edu	The Web site of Cornell University College of Veterinary Medicine covers animal disease states and some drug information. Look under Public Resources, Animal Health.
http://www.petdiabetes.org	This is a site for general information on diabetes in small animals.
http://www.felinediabetes.com	The site provides general information on diabetes in cats.

sued by the Food and Drug Administration, Center for Veterinary Medicine (FDA/CVM), illustrates compounding activities by pharmacists or veterinarians that are considered high-risk for regulatory action by the FDA/CVM (9). Once at the pharmacy, students must analyze requests for compounded medications using information gained from the published guidelines and laws to discern appropriate compounding requests from inappropriate requests.

While at the pharmacy, students are able to view and examine bulk drugs commonly used in treating animal diseases. Under the supervision of a licensed pharmacist, students actively compound flavored chewable tablets, potassium bromide solution, diethylstilbestrol (DES) capsules, and common otic preparations. They also communicate with veterinarians when receiving verbal prescription orders. Veterinary prescriptions are prepared and dispensed for animal clients, and their owners receive counseling from the students on indications for the compound, how to administer the drug, what to expect, and storage conditions.

The students report receiving great benefit from the hands-on compounding of animal dosage forms at the community pharmacy site. They are able to put into practice knowledge and skills obtained in pharmacy calculations and pharmaceuticals to assist in making elegant, palatable, accurate dosage forms for companion animals. These activities support the clerkship objectives whereby students shall demonstrate the ability to accurately interpret and compound prescriptions from veterinarians for human label drugs used in companion animals.

Students are graded on a pass/fail basis for participation, compounding knowledge, communication skills, ability to apply regulatory guidelines, and attitude. Students present detailed, descriptive reports of their compounding pharmacy activities to the instructor and the other clerkship student during weekly roundtable discussions.

Professional Veterinary Products Inc.

A collaborative effort with Professional Veterinary Products (PVP) was initiated to expose the clerkship students to the vast product lines of prescription and over-the-counter veterinary pharmaceuticals available. PVP is a local company that sells equipment, pharmaceuticals, and biologicals to veterinarians nationwide. During their two-day active learning experience, the students are given unrestricted access to explore the large inventory of veterinary products located in the PVP warehouse. Students are given a checklist of 30 veterinary products to locate. Once they have located the products, they are required to perform activities, which are documented on the checklist, that introduce them to new veterinary dosage forms and pharmaceuticals. Students must list the indications for products, read package inserts to note administration requirements or identify human health concerns of specific pharmaceuticals. They are required to note the strength and dosage variations within various product lines and to note the classification of prescription or over-the-counter status of several pharmaceuticals. Additionally, students must identify animal-specific dosage forms such as intramammary infusion syringes or balling guns and describe their use in veterinary medicine. These activities give students a preliminary introduction to the many veterinary products available for treatment of disease in animal patients. These exercises support global ability-based outcome of medication distribution whereby students are able to dispense medications consistent with animal needs.

PVP also possesses a large, secure vault that houses the controlled substances inventory. Students observe the record-keeping processes of

the business and are exposed to the quantities and use of controlled substances by veterinarians. This activity supports the clerkship objective of familiarity with controlled substances inventory requirements using systems management.

Zoo

In an effort to educate students on the fragile nature of exotic animals, a shadowing program with the Henry Doorly Zoo in Omaha has been established. At this site, students spend one day paired with an animal caretaker and shadow that zoo employee as he or she performs daily care, feeding, and medication responsibilities. As part of the shadowing program, students are included in any veterinary surgery, diagnosis, or routine health exam of the exotic animals conducted by the staff veterinarians on that day.

At the zoo, many of the routine medications or nutritional supplements are administered to the animals in their food. The use of herring or mackerel as a drug delivery system for the administration of the penguins' nutritional supplements promotes "nonlinear" critical thinking skills needed to solve the problem of how to administer supplements or medication in these kinds of situations. Additionally, students learn about the importance of monitoring water quality in the zoo's aquariums to prevent bacterial or viral disease outbreak. Students participate in the daily assessment of food intake of animals and receive instruction on how this measurement is an indicator of illness in exotic animals.

These situations help the students develop thinking skills needed to solve the problem of administering nutritional supplements and medications or preventing disease outbreak. Some students have observed and assisted with annual primate physicals, while other students have assisted with rabies immunizations of wolf pups. Other scenarios of how to take the blood pressure of a giraffe or knowing exactly when a Bengal tiger has been completely anesthetized by the blow darts require new knowledge on the student's part that is obtained from the animal caretaker and veterinarians.

The zoo rotation involves unusual activities, such as preparation of animal exhibits, assisting with restraint of animals during medical procedures, or relocating ill animals to the hospital. While these examples do not have a direct application to the provision of pharmaceutical care, they are a component that can teach valuable communication and social interaction skills to students.

Due to the variability of animal health activities that occur on any given day at the zoo when students are shadowing, their activities are graded on a pass/fail basis. It is difficult to compare a student's performance at this site because there are no standardized lists of activities at the zoo whereby students' participations in these activities can be assessed. For example, the learning activities in the aquarium exhibit can differ greatly from those in the hoof-stock exhibit. It is during weekly roundtable discussions that students present detailed and descriptive reports of their zoo activities and explain how they relate to issues of animal health, team-building skills, citizenship, and issues of lifelong learning. Upon reflection, students recognize that they are experiencing a once-in-a-lifetime opportunity at this site.

Nebraska Humane Society

A collaborative program with the Nebraska Humane Society in Omaha has also been developed. This veterinary site is the essence of a service-based learning experience and incorporates important citizenship skills into the clerkship. Students are assigned for two full days to actively participate in the feeding, medicating, and surgical needs of adoptable dogs and cats. Daily activities include medication rounds with a veterinary technician, preparation of dogs and cats for spay and neuter surgeries, observation of surgeries, assisting with surgeries, observation of postoperative recovery of animals, observation and assessment of controlled substances use in animals, and the development of communication skills between pharmacy students and veterinarians.

Prior to their assignment at this site, students are required to explain and describe to the instructor the human and veterinary label anesthetics and analgesics used at the humane society for presurgical induction and pain control. They are graded on a pass/fail basis using the criteria of participation, attitude, task completion, and ability to describe common analgesics and anesthetics.

The use of controlled substances for pain control in dogs and cats is optimized at the Humane Society. This provides an environment in which students can assess the outcomes of pain management postoperatively in dogs and cats. This clerkship activity supports the ability-based educational outcomes of drug therapy evaluation whereby students assess and monitor the patient's drug therapy. One group of students was asked by the staff veterinarian to assess the in-house record-keeping activities of controlled substance use and to identify any deficiencies. Students are asked to organize, alphabetize, and check expiration dates of

the in-house medication stock in the surgical ward. The students have identified some outdated medications and have used that opportunity to educate the veterinarians and technicians on the potential toxicities of using outdated antibiotics. These activities support the systems management and the medication preparation and distribution components of the clerkship objectives.

One contribution made by the pharmacy students to the Humane Society has been drug education. Pharmacy students are required to conduct in-service presentations to the veterinarians and veterinary technicians on the dosages, indications, contraindications, and toxicities of the top 40 drugs used at the Humane Society. This particular learning experience pulls many professional and educational aspects together, such as presentation skills, public speaking skills, interdisciplinary education, drug informatics, disease state research, and the use of technology skills in the construction and presentation of the in-services.

While at the Humane Society, pharmacy students get the unique experience of working side by side with veterinary students. This Humane Society serves as a surgical rotation site for students from four veterinary medicine schools: Iowa State, Colorado State, Kansas State, and Cornell. This is an excellent environment for developing pharmacist-veterinarian communication skills as well as reaping the advantages of interdisciplinary education. Students report feeling comfortable in asking veterinary students about their educational curriculum and discussing the similarities and differences between the two professions. This has proven to be an eye-opening experience as pharmacy students become aware of the extent of in-depth drug education that they receive compared to veterinary students. This activity helps the students develop an appreciation for their ability to recommend human label drug therapy for veterinary conditions and to resolve drug-related problems, two skills that are core to pharmacotherapy decision-making abilities. These skills are vital to a graduate who wishes to practice any kind of veterinary pharmacy in a community practice.

Local Veterinary Clinics

Privately owned veterinary clinics and hospitals in the Omaha area have been recruited to host the clerkship students for two to three days. Students are nearing the end of their veterinary clerkship by the time they reach this final site. It is reserved for last because it incorporates many different aspects of veterinary medicine and veterinary pharmacy into the provision of veterinary medical care to animal patients for a fee.

Students are assigned to a specific veterinary clinic or hospital to observe and participate in the practice of veterinary medicine. Students receive hands-on instruction in diagnosis, treatment, drug therapy selection, surgeries, trauma cases, euthanasia, client education, human-animal bond, and economic factors that drive veterinary medicine.

Several clinics and hospitals were recruited for this learning experience, and students are assigned based on a rotating clinic schedule. This helps prevent any one clinic or hospital from becoming overburdened from a continuous stream of pharmacy students. Using this rotation method, any one veterinary clinic in Omaha will have only three to four students per year.

After completing their assignments at local veterinary clinics, students report high levels of interaction with veterinarians and animal patients during this activity and express a deeper appreciation for their veterinary pharmaceutical and animal health educational experiences up to that point. The disease state and case research that is assigned to the clerkship students also serves as a knowledge base while at these sites. Diabetes, hypothyroidism, and infectious diseases are common presentations in veterinary medicine, and the students are well prepared with an understanding of these conditions.

Students have commented on the limited numbers of approved pharmaceuticals for use in veterinary medicine compared to human medicine and how this situation makes the treatment of animal diseases more difficult and frustrating. This observation serves to reinforce the different roles that economics and resource availability play in veterinary medicine versus human medicine. Opportunities to participate in and observe a clinical practice enable students to compare and contrast the differences in human and veterinary medicine so they will have a clearer understanding of the pharmacotherapy needs of animal patients. The knowledge obtained from these activities and observations underscores the need to have effective communication skills when dealing with veterinarians and animal owners about drug therapy. These activities support the communication skills clerkship objectives whereby students shall communicate with veterinarians, veterinary technicians, and other professionals in the animal health industry.

Students are required to present detailed, descriptive reports of their veterinary clinic activities to the instructor and the other clerkship student during weekly roundtable discussion. They are graded on a pass/fail basis for participation, use of communication principles, detail of the descriptive report, and attitude.

Other Associated Sites

As an additional activity during this rotation, tours of local animal health companies have been arranged. The Nebraska Veterinary Diagnostic Laboratory in Lincoln, Nebraska, provides an environment for students to make the association between knowledge gained from the pharmacy curriculum and its application to animal health. The laboratory houses areas with specific focus and function such as histology, virology, bacteriology, toxicology, and necropsy (autopsy). The students are given a tour of the laboratory by one of the staff toxicologists. The objectives of the laboratory are discussed. Some of these objectives include: protection of the general public and animal populations from contagious diseases such as foot and mouth disease, rabies case investigation, toxicology assays in animal poisonings, culture and sensitivity reports for veterinarians, and gross pathology findings of animal tissue samples. If the laboratory is conducting a necropsy at the time of the tour, students are invited to observe. The activities at this site do not have a direct link to the clerkship objectives, but they expose the students to the important services that a veterinary diagnostic laboratory performs. Students positively reflect on their ability to compare and contrast knowledge in human virology, toxicology, and bacteriology to animal health situations.

DISCUSSION

It is the responsibility of the instructor to tie knowledge gained by the students from project assignments, observations, and participatory experiences while on the clerkship to the ability-based educational outcomes for School of Pharmacy graduates. This is accomplished through weekly roundtable discussions and personal communication with the students, critical review of disease state research assignments, descriptive reports, discussion of specific veterinary cases, review of veterinary informatics, and use of corresponding examples from human medicine. As students pull together the research, participatory, and observational activities of the entire clerkship, they report feeling confident in their ability to comply with the verbal consulting requirements of pharmacy practice so they may competently provide pharmaceutical care services to their animal patients.

The clerkship shows great promise for future development and continuation. Four of the 12 students completed nonmandatory evalua-

tions, all overwhelmingly positive in their feedback and commentaries. Students have made suggestions to incorporate more information on the mechanisms of the human-animal bond, such as the roles animals can play in reduction of blood pressure and other related life-style issues.

CONCLUSION

This article has described one model that faculty can use to establish a veterinary pharmacy clerkship at their institution. This teaching institution and clerkship have benefited from the numerous veterinary sites and animal health resources located in the Omaha area. While every community may not have the same type or number of veterinary sites available for the education of pharmacy students in a similar clerkship, this manuscript has described one possible approach toward the education of fourth-year Pharm.D. students who desire more knowledge about veterinary pharmacy and veterinary medicine.

Preliminary educational outcome assessments from this clerkship have been positive, suggesting that the clerkship design is effective in accomplishing the educational goals. Students appear to be achieving the objectives of the clerkship by reporting increased confidence in their veterinary disease state and pharmaceutical knowledge as well as new skill development that can enhance their professional competence in the practice of veterinary pharmacy.

Now that dependable and predictable relationships with local veterinary sites have been established, the next step toward improving this clerkship will be to establish a formal method of documenting and assessing educational outcomes.

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