

SECTION 5

TEACHING VETERINARY PHARMACOLOGY

Chairpersons

Dr. Gordon L. Coppoc

Dr. Wayne S. Schwark

Goals in Teaching Basic Pharmacology in the Veterinary Curriculum

Gary D. Koritz, D.V.M., Ph.D.

Professor of Veterinary Pharmacology, Department of Veterinary Biosciences,
College of Veterinary Medicine, University of Illinois, Urbana, Illinois 61801

Introduction

The Journal of Veterinary Medical Education contains a number of articles relevant to this subject, many written in response to the Ninth and Tenth Symposia on Veterinary Medical Education and the Pew National Veterinary Education Program. I highly recommend that educators in veterinary pharmacology read these articles, some of which are cited in this paper. The reader will find, however, that the veterinary curriculum is addressed as a whole and rarely are the specifics of basic veterinary pharmacology discussed.

In this paper, I first briefly describe the average state of instruction in veterinary pharmacology and the forces responsible (see section on "Reality"). It then seemed logical to mention a few of the current attempts to create change in instructional goals and methods (see "Transition"). Finally, I suggest some goals and methods in teaching basic veterinary pharmacology, not in an idealized world of unlimited human and financial resources, but in the academic environment of the near future beset with human and budgetary constraints (see "Possibility").

Reality

A survey of the status of the curricular content of veterinary pharmacology in all of the veterinary schools in the United States and Canada was conducted in 1986 (Short, 1987). An average of 68 lecture hours was found to be devoted to lecture in basic pharmacology with 83% of the lectures presented in the second year of the curriculum. Pharmacology laboratory instruction averaged 23 contact hours and discussion sessions 8 contact hours. Thus, the total mean contact time for basic veterinary pharmacology was 99 hours.

Surveys conducted in 1985 and 1986 of the same veterinary schools served to define the role of the student laboratory in teaching basic veterinary

pharmacology (Aronson & Short, 1988). Three-fourths of the schools presented pharmacology laboratory sessions. The student laboratory was considered to be a cost and time effective means of teaching pharmacology by 61% of the respondents.

These surveys did not determine course content. One must attempt to do so, however, especially in light of current concerns with excessive presentation of factual material as a result of the "cult of coverage" (Armistead, 1987) and "information explosion" (Ward & Bushby, 1987). One must define a "code of behaviors" and an essential "core of knowledge" to be imparted by a course in basic veterinary pharmacology. I contend that the core of knowledge does not (and should not) extend beyond that of a comprehensive textbook such as *Veterinary Pharmacology and Therapeutics* (Booth & McDonald, 1988). Furthermore, it is impossible to "cover" all of this material within 99 contact hours and, therefore, the core of basic veterinary pharmacology is humanely less than that presented within the 1206 pages of the aforementioned text.

Based upon my own rather limited perspective, the typical basic veterinary pharmacology course (of which, I am guilty) appears to be delivered almost entirely by lecture together with voluminous handouts (rather than a text) with little time allowed for questions/discussion so that the maximum number of drugs can be "covered" in the allotted period of time. Furthermore, the most frequent method of student evaluation is the multiple-choice examination which requires very little professorial time as compared to an essay examination.

How did the instruction of basic veterinary pharmacology arrive at the *modus operandi*? In the era of 1960-1970, there was a shift in emphasis from teaching to research throughout academia and a concomitant decrease in faculty time devoted to teaching. Furthermore, the reward system of salary increases, promotion, and tenure favored research

over teaching. Simultaneously, the students desired increased "spoon feeding" of information and discovered the tool of negative instructor evaluations to provide pressure in that direction. The faculty response was to increase the volume of handouts as a cost and time effective means of "spoon feeding" large amounts of factual information and to evaluate the students' ability to "digest" this information with cost and time effective multiple-choice examinations. The decline in state and federal support of higher education in the 1980s reinforced this faculty behavior. These factors and others serve to maintain the status quo and inhibit attempts to change current methods of instruction (Armistead, 1987).

Transition

Some far-sighted individuals and institutions have made and/or are continuing to make changes in the instruction of basic veterinary pharmacology. We applaud the early efforts of individuals such as Gordon Coppoc to decrease memorization and increase independent student learning with MEDIC (minimum essential drug information checklist) (Coppoc & Stuckey, 1977). Jack Oliver initiated a multidisciplinary student laboratory in physiology and pharmacology with input from surgeons, anesthesiologists, and other clinicians (Oliver & Sims, 1979). More recently, Phil Bushby and the College of Veterinary Medicine at Mississippi State University have promoted the use of computers to contend with the information explosion in the veterinary curriculum (Ward & Bushby, 1987). And now, the School of Veterinary Medicine at Purdue University has revolutionarily restructured its curriculum.

The taxpayers of many states and the nation have chosen not to support higher education in the style to which we were once accustomed. In response, educators are being asked by their institutions to provide not only more cost effective instruction, but better instruction, to the sons and daughters of those tax payers. In other words, the instructor is to do more with less in the hope that the institution will someday receive more.

Possibility

Comprehensive overviews of the need and means for change of the veterinary curriculum are provided in the proceedings of the Ninth (Ames *et*

al., 1987) and Tenth (Ward, 1989) Symposia on Veterinary Medical Education. Constructed somewhat upon those concepts, I offer for consideration one of many possibilities for change in the goals and methods of instruction of basic veterinary pharmacology. If my proposal seems limited or unimaginative, it is in part because it is made under the assumption that at most veterinary schools only limited additional resources in terms of faculty time or teaching assistant stipends are likely to be provided in the near future and those primarily through the process of reallocation.

Goals

The goals of instruction in basic veterinary pharmacology can be expressed in as many ways as there are instructors in the discipline. To provide a common thread to the goals of the other disciplines in veterinary medicine, I have chosen to express my goals by paraphrasing the desirable characteristics of a 21st century graduate (Ward, 1989) in terms of what instruction in basic veterinary pharmacology should provide.

1. Competence in oral and written communication concerning veterinary pharmacology.
2. A general understanding of the world of pharmacology, its culture and its people.
3. A fundamental grasp of the concepts and principles of pharmacology.
4. A knowledge base of the important concepts and principles of veterinary pharmacology, and entry level ability to receive clinical instruction.
5. The essentials of scientific behavior to include thoroughness, reliability, efficiency, and critical analysis.
6. Problem solving and critical thinking skills.
7. Training and experience in pharmacological investigations.
8. Experience and skills in modern information management systems.
9. Commitment to sustained scholarship and professional development in veterinary pharmacology, and the necessary skills to achieve these ends.
10. Personal integrity and ethical values including compassion for people and animals.

Methods

Billy Ward (1989) clearly stated what must be done to ensure that students acquire such characteristics. "A curricular structure must be in place and learning strategies must be specified for each characteristic. More important, evaluation and feedback strategies must be appropriate for each characteristic. Some of these attributes cannot be taught in a lecture and cannot be measured by multiple choice examinations or other types of written examinations."

A portion of a course syllabus for 20 of 90 hours of lecture/discussion/evaluation in basic

veterinary pharmacology which I hope to implement in the near future is provided. The method of instruction is as old as Socrates, based upon the posing of questions to which students, either individually or in groups, respond orally or in writing. The students will be expected to have prepared for these questions through independent study. Lecture handouts will be greatly reduced in favor of reading assignments in veterinary pharmacology text(s) and other information sources. Student evaluation will be based upon ability to think critically, solve problems, and communicate thoroughly, reliably, and efficiently.

BASIC VETERINARY PHARMACOLOGY: A PARTIAL SYLLABUS

SECTION ONE:

READING ASSIGNMENT	QUESTIONS TO CLASS	CLASS DISCUSSION	OTHER
Introduction to basic veterinary pharmacology, 1-23	How would you manage an animal in acute respiratory distress?	MEDIC and HAEDMETU lists, sources of information	Goals Grading
Pharmacodynamics, 25-37	What are possible receptor shapes for this hypothetical drug? How does the receptor produce a pharmacologic effect? How can drug effects be measured?	Stimulate discussion, clarify concepts, dose response curves	Take home study questions (not graded)
None	Discuss answers to take home questions		
Drug Absorption, 38-47	What are important things to know about absorption of a drug? What influences drug absorption?	Clarify pH/pKa, ion trapping, dosage form and physiologic effects	
Drug distribution, 54-55	Why do some IV anesthetics have such a short duration of action?	Clarify effects of partition coefficient, blood flow, membrane barriers, protein binding	

Drug metabolism, 56-63	Why is the same dose of aspirin toxic to cats but safe for dogs? Why are PCBs persistent?	Clarify Phase I and II reactions, P450 system, saturation, induction, inhibition	
Drug excretion, 63-65	Why are aspirin metabolites found in bile and urine? Would you expect any difference in excretion rates of salicylate by dogs versus cattle?	Clarify renal and biliary excretion mechanisms, pH and pKa effects, enterohepatic recycling	Take home study questions
None	Discuss answers to take home questions		
Pharmacokinetics, 47-54, 65-69 Drug and chemical residues, 1149-1170	Given certain information, how would you use theophylline to treat an asthmatic cat?	Clarify clearance, volumes, rates, half-life, dosage regimen calculations, flip-flop, drug accumulation, steady-state, residue concerns	Take home study questions
None	Discuss answers to take home questions		

FIRST EXAM - open book, two hours of essay, calculations, short answer, and multiple choice.

LABORATORY - in parallel to the above sequence of 5 weeks of lecture/discussion/evaluation is an integrated physiology/pharmacology laboratory. During this period, the laboratory instruction will include lecture, discussion, computer exercises, data analysis, dosage regimen design, and written and oral reports by the students on the pharmacokinetics/pharmacodynamics of various example drugs employed in veterinary therapeutics.

SECTION TWO:

READING ASSIGNMENT	QUESTIONS TO CLASS	CLASS DISCUSSION	OTHER
Introduction to the Autonomic Nervous System, 73-90	What are the signs of an intravenous injection of epinephrine; of acetylcholine?	Neurotransmission in the ANS; use diagrams	Write short review on an ANS drug

Cholinergic pharmacology: ANS drugs, 117-136	What are the signs of OP toxicity? Explain the mechanisms.	Nicotinic & muscarinic receptors, acetylcholine, neostigmine, physostigmine, DFP, parathion, pralidoxime	
Anticholinesterases and Parasympathomimetics	Why do these drugs act differently in the animal body?	Acetylcholine, methacholine, carbachol, bethanecol, pilocarpine	
Parasympathetic blockers	How would you treat OP toxicity?	Atropine, scopolamine, glycopyrrolate	Take home study questions (not graded)
None	Discuss answers to take home questions		
Adrenergic and antiadrenergic drugs, 91-116	What are the effects of intravenous epinephrine, norepinephrine, & isoproterenol? Explain the mechanisms.	Discuss adrenergic receptors, epinephrine, norepinephrine, isoproterenol, dopamine, ephedrine, phenylephrine, dobutamine, terbutaline, propranolol, phenoxybenzamine, prazosin, yohimbine	
Ganglionic blockers, 133-136 and Neuromuscular blockers, 137-151	What are the signs of nicotine toxicity? Explain the mechanisms.	Ganglionic neurotransmission, nicotine, hexamethonium Neuromuscular junction, curare, gallamine, succinylcholine, decamethonium	Take home study questions
None	Discuss answers to take home questions		

SECOND EXAM - open book, two hours of essay, calculations, short answer, and multiple choice.

LABORATORY - in parallel to this second sequence of 5 weeks of lecture/discussion/evaluation will be an integrated physiology/pharmacology laboratory concerning drugs which affect the cardiovascular system. Videotapes, computer simulations, animal laboratories, demonstrations, and current clinical cases will be used.

Reading assignments are in the text *Veterinary Pharmacology and Therapeutics* (Booth & McDonald, 1988) which the students will be required to purchase. Other texts and sources of information will be placed on reserve in the library.

The students will be provided with the MEDIC and HAEADMETU lists. Abbreviated forms of these lists follow.

MEDIC: MINIMUM ESSENTIAL DRUG INFORMATION CHECKLIST (Coppoc, 1977)

1. What is your therapeutic goal?
2. What route(s) of drug administration will be used?
3. What dose form(s) will be used?
4. What dose will be used?
5. What dose interval will be used?
6. What will be the duration of therapy?
7. What is the withdrawal time if used in a food animal?
8. What is the cost of the drug and its administration?
9. What must be done to enhance drug efficacy and safety?
10. What are the contraindications to drug use?
11. What are the potential adverse reactions?
12. What are the antidotes or corrective measures?
13. What plans do you have to evaluate therapeutic results?

As noted by Dr. Coppoc (1977), "MEDIC transcends a basic course in pharmacology or any particular teaching philosophy". Therefore, I created the next list which reflects my philosophy of what drug characteristics are important in the instruction of basic veterinary pharmacology.

HAEADMETU: (Hey, add me too)

1. History of the origin of the drug.
2. Action of the drug.
3. Effects of the drug.
4. Absorption of the drug.
5. Distribution of the drug.
6. Metabolism of the drug.
7. Excretion of the drug.
8. Toxicity of the drug.
9. Uses of the drug.

Conclusion

This is an incomplete effort to describe some of the goals and methods of instruction in basic veterinary pharmacology and to list some of the topics and drugs which I consider to be core information. I encourage other instructors in the discipline to share their thoughts on this subject. Hopefully, the American Academy of Veterinary Pharmacology and Therapeutics will continue to provide the leadership and expertise to accomplish this very important task and to share the information generated with its membership, the Association of American Veterinary Medical Colleges, interested veterinary schools of other nations, and the Pew National Veterinary Education Program.

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