

The Potential Impact of Contemporary Issues on the Teaching of Pharmacology

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Introduction

We are obviously living in an era of profound and rapid change. New developments in regional, national and international socio-political arenas have become a daily occurrence. Scientific and technological advances are reaching new heights. Societal demands and expectations are approaching levels previously not considered realistic nor even attainable. An idea or discovery can be in practical commercial use within months provided it does not require any form of federal approval.

In this world of growth, flux and frequent perturbation, the veterinary profession, and more particularly the veterinary educational institutions, now find themselves on quite stormy seas faced with a number of uncertainties yet determined to respond to the shifting paradigms of the late 20th century in an effort to prepare themselves for what may be ahead. I personally believe that we have an array of undeniable and important roles to play as a profession in many diverse arenas during the coming years, and, frankly, could not be more optimistic about the future of veterinary medicine provided that we respond to each challenge that is presented to us in an appropriate and responsible fashion.

In this brief review, I would firstly like to address just a selection of contemporary issues that I feel are going to influence the teaching of pharmacology at our schools and colleges of veterinary medicine. What the potential impacts may be will then be addressed. My own expectations of what changes might occur in the academic arena will then be noted which will be followed by a few predictions of how these changing times will place new demands on us as academic pharmacologists.

Contemporary Issues of Some Consequence for Academic Pharmacologists

The following are just a few issues that clearly are going to influence content and emphasis in

the veterinary pharmacology courses that will be taught in the coming years.

Responsible and Appropriate Drug Use

Society now justifiably expects a high degree of competence from the members of the various professions. Almost of greater importance, our own ethical standards simply demand that drugs be employed in a correct and responsible manner. It is up to us, in large measure, as academic pharmacologists to lay the ground work to ensure that this is indeed the case.

Food Safety and Quality Assurance

Today, perception is often reality, and even with only a relatively limited number of reported cases where residues have indeed been detected in meat and milk, the public's perception is still that our food of both plant and animal origin is frequently contaminated with "chemicals" or "foreign substances". We as a profession will have to contend with this thinking for some years to come and the onus will be primarily on academicians to ensure that all practicing veterinarians fully understand their professional responsibilities in this regard.

New Technologies

There is absolutely no doubt that the rapid and ever-expanding development of new technologies will have a direct bearing on the teaching of pharmacology—not only through the continued introduction of new drugs but also because of the emerging use of bio-engineered natural physiologically active peptides for both production and therapeutic purposes. In addition, we will have to contend with an ever-increasing sophistication of analytical techniques and even rapid screening tests. Advances are also constantly taking place in the development of novel drug delivery systems as well as of methods to ensure animal identification.

Legislation and Regulations

We are in an era of great sensitivity about many issues pertaining to veterinary medicine--not the least of which is the use of drugs in animals for therapeutic, performance-enhancing and production purposes. Politicians and regulatory agencies are responding in a predictable fashion. Hence FDA-CVM, USDA-FSIS, EPA, DEA, FTC and other agencies are actively promulgating regulations deemed to be appropriate for the protection of the public's interests. These tendencies will continue and will probably become even more intense and restrictive in the future.

Society's Expectations

Today's average citizen has high expectations of pharmaceuticals and other related products. He or she also believes that the purveyors of the healing arts should be near perfect and if they appear to have erred, should be promptly sued. Our average citizen is also convinced, because we have pronounced it to be the case on so many occasions, that the U.S. has the safest food in the world. This is probably the case but in some ways we might well have set standards and expectations which, with all things considered, may well not be fully realistic. However, we will have to deal with them as best as we are able on all fronts.

The Shrinking Globe

As the various barriers between countries diminish and scientific, trade and cultural exchanges become more and more prevalent, the veterinary therapeutic pantry may well become better and better stocked - both with new products and, perhaps even more importantly, with a greater array of bright ideas. Only time will tell where the U.S. will find itself after the process of "internationalization" is fully established.

Animal Rights Movement

Most of the groups and organizations that regard themselves as part of the animal rights movement are here to stay and we are in for a protracted period of profound debate on the ramifications, dimensions and possible impacts of the issues that have been and are yet to be enunciated. There is absolutely no doubt that the animal rights movement is having and will continue to have a direct influence on the teaching of veterinary pharmacology not only because of the use of animals

in teaching and research laboratories but also because of the need to expand some specific course content. In many ways, the animal rights movement has presented the veterinary profession with a golden opportunity to take its rightful place as a group of primary animal welfarists. However, there is yet much to be done--especially in the realm of pharmacology and therapeutics.

Environmental Concerns

The quality of the environment is an issue that is presently very high on the public's awareness list. Transmissible antibiotic resistance, the artificial creation of new species of "super" microbes and the misuse of pesticides being three good examples of topical environmental concerns. We in veterinary pharmacology clearly have several responsibilities in this regard.

The "New" Veterinary Medicine

Following a spell of active and serious introspection, it is now quite obvious that the veterinary medical educational institutions in North America are in the process of undergoing many changes both in the breadth of their role and scope in modern society as well as in dealing with an exploding knowledge base. Amongst several emerging tenets that will probably govern the "new" veterinary medicine in the future, is one that places emphasis on the maintenance of health rather than the treatment of disease.

Revision of Veterinary Medical Curricula

Another current issue that is undoubtedly going to have a major impact on veterinary pharmacology is the wave of change that will sweep through the curricula of schools and colleges of veterinary medicine as a result of their strategic planning efforts during the past two years. Many are already scrutinizing their curricula in some detail with a view towards an appropriate response to the emerging strategic issues.

Non-Traditional Species

As a facet of veterinary medicine's expanding horizon, it is now quite evident that a number of animal species not commonly regarded as regular "patients" in the past are now demanding attention--very often from a therapeutic perspective. Examples include ferrets, gerbils, many common

laboratory animal species, exotic animals, cagebirds, ratites and numerous aquatic species such as alligators, fresh and salt-water fish, crustaceans, and mollusks.

Knowledge "Explosion"

It is important to remind ourselves that we live in a time when new knowledge is being generated and applied in every scientific field at a pace beyond any encountered in the past. Nothing would suggest that this will not continue unless a major global calamity were to occur.

The Impact of Current Issues on the Teaching of Pharmacology

Most of the issues outlined above are going to have a direct effect on the content of pharmacology courses as well as on their delivery in many instances. The following aspects will probably enjoy special emphasis in order to meet the demands being placed on the profession.

Basic Versus Clinical Content and Emphasis

This is going to be a very difficult matter to deal with for academic pharmacologists. With the inevitable time constraints that can be anticipated in future pharmacology courses, some very critical decisions will have to be made about how much time and the degree of emphasis that should be devoted to basic elements such as the class of pharmacological agent, the typical members of the group, physicochemical properties, mechanisms of action, pharmacokinetic characteristics, therapeutic indications, potential adverse effects, drug and nutritional interactions, available pharmaceutical preparations, and the special concerns or features associated with administration or clinical use. It may be that a core course will be needed followed by one of two course options -one much more basic and the other very clinical depending on the students' interests. Perhaps even more provocative would be the thought that some students, because of special career goals, might require no more than a core introductory course in pharmacology.

Drug Residues and Monitoring Techniques

The issue of drug residues together with the pharmacokinetic principles governing their occurrence and the critical need to avoid residues in food animals (as well as in the animal athlete for that matter)

simply must be addressed in our pharmacology courses. I regard this as a major obligation of today's academic pharmacologists. For a complete understanding of what is at stake, the techniques that are available to monitor residues should also be covered. My personal impression is that today's graduates are in fact more cognizant of this important facet of veterinary practice than in the past.

Extra-label Drug Use and "Flexible" (professional) Labeling

As a profession we currently enjoy the opportunity to employ drugs in an extra-label manner provided the well-known criteria are met. The basis for this decision in large measure was the fact that veterinarians were trained to the level at which they were capable of exercising discretionary judgement with respect to the use of drugs in animals--and rightfully so! The great concern is, of course, in food animals although the restrictions theoretically apply to all species. For veterinarians to continue to enjoy the privilege of employing pharmaceutical preparations in an off-label or extra-label fashion or with greater flexibility, it is up to us as academic pharmacologists to ensure that our own graduates indeed appreciate all of the implications of using a drug either in a different species from that intended or at dosage levels that are at variance with those recommended or by routes other than those stated. I am confident that this can and will be done but the key balance between clearly understanding basic concepts and the practical field use of veterinary drugs will have to be addressed with forceful clarity in what might well turn out to be an abbreviated time span.

Availability of Generic Products

Future students will have to be made fully aware of the principles of generic equivalence and the basis of approval of generic products. Quality assurance of generic products will be in the hands of FDA-CVM but the process should be appreciated by practitioners.

Regulatory Aspects

Whether in their courses in pharmacology, toxicology, public health, medicine or herd health, students must be made aware of the significance of the current laws and regulations. Topics should include the differences between prescription versus over-the-counter preparations, extra-label drug use,

veterinarian-client-patient relationships and the importance of drug withdrawal and milk discard times.

Reduced Contact Time in the Core Curriculum

With the increased demands being placed on veterinary education and the diversity of career alternatives that are becoming available, together with the perennial problem of an exploding knowledge base, an inevitable consequence is going to be reduced student contact time in the core curriculum. Elective options will probably become more prevalent in most curricula. The teaching of pharmacology is going to have to become a compact yet efficient process during which the fundamental elements will have to be delivered and understood in an effective fashion. This might well be done through joint efforts between various schools and colleges--either as loose informal arrangements or more structured consortiums.

Covering Non-Traditional Species

As the veterinary profession engages in the care of an ever-growing array of animal species, it is becoming very apparent that our knowledge is often quite flimsy as we are called upon to treat the more esoteric species. Yet we have to do what we can by extrapolating basic principles and general knowledge--sometimes successfully but on occasion with detrimental results. This need can realistically only be met by elective options but the principles must be well covered in the basic course or courses. Species of interest might include many exotics, marine mammals, other aquatic species (finfish and shellfish), reptiles, ratites, wild birds and many others.

Understanding Basic Concepts

Clearly from what has been outlined above and what will be addressed below, a solid understanding of basic pharmacological concepts is critical. Physicochemical characteristics; mechanisms of pharmacological action; principles of absorption, distribution metabolism and excretion; pharmacokinetic properties; mechanisms of adverse reactions; pharmaceutical considerations; drug delivery systems; and epidemiological concepts are essential components. We must prepare our students so that they can keep up with any future developments on their own.

Novel Drugs, New Delivery systems and Therapeutic Drug Monitoring

Once again a sound appreciation of pharmacological principles will be essential to the understanding of each of these issues.

Developments in Closely Related Disciplines

With the expansion of scientific knowledge and with the recent developments in the fields of molecular and cellular biology, many disciplines are moving closer together with significant overlap becoming more and more common--examples include toxicology, nutrition, medicine, anesthesiology, theriogenology, public health and several others. Unnecessary duplication will have to be avoided within the curriculum.

Anticipated Responses

Some of the responses to the impact of contemporary issues on the teaching of pharmacology might be expected to include all or some of the following during the next few years.

- New pharmacology syllabi (core and elective options)
- Expanded emphasis on regulatory aspects.
- Enhanced awareness of professional responsibilities.
- Innovative and effective teaching techniques and modalities.
- Shared resources, programs and courses.
- "Packaging" of information for target consumption.
- Development of effective and readily accessible data retrieval systems.
- Increased number of graduate and residency training programs.

A Few General Predictions

As several others have done during this symposium, I would also like to offer a few general predictions of how I feel the world of veterinary pharmacology and therapeutics might change during the next decade or two.

Veterinary Technicians

Veterinary technicians will play an ever-increasing role in both private and institutional veterinary practice. Their many duties will include drug administration, therapeutic drug monitoring, patient observation and keeping case records.

Clinical investigations

There will be a much greater emphasis on well-designed and carefully conducted clinical studies in the place of basic investigations employing large numbers of laboratory animals. Spontaneously occurring diseases in various animal species will also be of much greater interest in the human medical field.

Enhanced Reporting and Information Networks

Electronic communication between institutions and practices will facilitate the rapid exchange of information.

Special Licensing and Board Certification

Some form of discretionary licensing and/or board approval will probably evolve during the next 5 to 10 years.

Expanded Career Opportunities

We are moving into an era during which veterinary medicine will have a great deal to offer and will also have several new and expanded roles to play in society. There are a remarkable number of career options beginning to emerge for interested and qualified veterinarians.

Continuing Education

There will be a great need for continuing education programs in pharmacology and therapeutics. There is already increasing recognition of the critical role of pharmacology in the practice of modern veterinary medicine, notwithstanding the growing emphasis on the maintenance of health.

"Retreading" Veterinarians

Many veterinary graduates will require a greater or lesser degree of retraining as they enter new careers later in their professional lives. Many will have to relearn or be updated in pharmacology.

Specialization

Increased specialization in all fields is inevitable and will have to be accommodated.

Continued Innovation by the Pharmaceutical Industry

As difficult as recent times have been for many pharmaceutical companies, their indomitable

spirit will prevail and many novel and ingenious introductions into the market place can be expected.

Professional Marketing

Professionalism and sophisticated marketing will be key attributes of most veterinary practices during the next few years.

Selected Readings

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