

Alternatives and Veterinary Medicine

As we move week by week through various areas of humans' interactions and relationships with nonhumans, it may become apparent to you that veterinary medicine either now sits, or in the future can sit, at the intersection of virtually all crucial human-animal relationships. "Veterinary medicine" is, of course, an umbrella under which we find different elements, which is one of the reasons the Reflection Journal assignments have pushed you to think out your view of the roles of (i) individual veterinarians, (ii) veterinary education, and (iii) the veterinary profession as a whole.

This week we return to the area of research animals and the role these three distinct elements of veterinary medicine—veterinarians, veterinary education, and the veterinary profession as a whole—might play regarding "alternatives."

We begin with an announcement sent to all members of the TCSVM community by TCSVM's former Dean (Phil Kosch) in May 2005.

ALTERNATIVES PROGRAM INITIATIVE

TCSVM has been a pioneer in developing and adopting alternatives (refinement, reduction, and replacement) to the use of live healthy animals in delivery of our curriculum. The IACUC (Institutional Animal Care and Use Committee) on the Grafton Campus has also encouraged alternative approaches to the use of animals in research.

After consulting with the Senior Staff, I have included a 3-year funding plan in the school's budget recently approved by the university trustees to enhance our commitment to the use of alternatives and to develop a pain service in our hospitals. This funding will add two clinical faculty: a junior level laboratory animal veterinarian in the Division of Teaching and Research Resources (DTRR) and an anesthesiologist in the hospitals. These hires will enable existing DTRR and Anesthesia Service faculty to devote time to accomplish the following. I want our school to make further progress in the use of animal models and simulations prior to the use of live animals in our teaching program. This initiative will provide funds to obtain and test existing models. Tufts School of Medicine plans to establish a Tufts Medicine Simulation Network and I want TCSVM to be a satellite training site. I also want to support faculty with interest in developing and validating refinement approaches to use of research animals. Minimizing pain and distress when use of research animals is necessitated is a goal we are committed to. This initiative will provide seed funding for development of refinement alternatives. Along the same lines of alleviation of

pain and distress in research and teaching animals, I want us to establish a defined pain service for both in-hospital consultation similar to that done by clinical nutrition as well as direct care for cases referred for pain management. The additional anesthesiologist will also allow us to take on the increased workload associated with the permanent MRI facility to be built soon. The ultimate goal is that this alternatives program initiative will eventually contribute to a widespread change within the scientific and academic community beyond TCSVM. To this end, I want to encourage faculty and M.S. student participation from our Center for Animals and Public Policy to explore the policy challenges regarding adoption of validated alternatives by mainstream researchers and/or educators. The study of this advocacy process based on solid scientific evidence will be valuable as adoption of new methodology is the most difficult step in advancing alternatives.

I have charged the Director of DTRR, Dr. Karl Andrutis, to carry out this ambitious initiative. He will need the help of interested faculty in meeting the multifaceted goals outlined above. The funding provided over the next three years is intended to lay the foundation for securing extramural funding to sustain these efforts.

The pioneering role referred to in the first paragraph of this announcement has involved a number of different areas—alternatives to use of live animals in courses where surgery is taught, alternative sources of cadavers for use in educational labs, and various efforts to minimize and even eliminate use of live animals in education and research.

One of the **challenges faced by those who advocate alternatives** is the simple fact that it isn't always clear exactly what the field of "alternatives" entails—more on this below. As or more importantly, some people have argued that a search for alternatives to present approaches unfairly implies criticism of present and past practices. Others have argued that such a search can be, instead, an affirmation of research and science generally, as well as ethical instincts and values.

As to just what "alternatives" involve, consider the following Question & Answer sets that come from the website of Johns Hopkins' Center for Alternatives to Animal Testing:

Q: What are alternatives or what does the word alternatives mean?

A: The idea of alternatives in animal research can be broken down into three important subcategories: Reduction, Refinement, and Replacement. We call these the three R's. Everyone can understand replacement: it's what most people think of when they think of alternatives. Studying human or animal cells instead of a

whole animal (known as an in vitro method) is an example of a replacement alternative. Reduction alternatives are just what they sound like: methods that reduce the number of animals necessary for use in a test or experiment. Refinement methods are approaches to the use of animals that lessen or eliminate their pain and distress or that ensure more humane endpoints to experiments. For example, choosing an appropriate medication for pain relief following surgery is one type of refinement.

Refinement and reduction alternatives often are relatively easy to implement and require little change in experimental design, whereas replacement alternatives can take a great deal of time to develop -- and even longer to win approval by scientists and regulatory agencies. This is due to the need to validate new methods -- to prove that they will provide the needed information in a reliable manner.

Q: What does "not tested on animals" really mean?

A: Today, many cosmetics companies advertise their products as "cruelty-free" or "not tested on animals." Some possible meanings of "not tested on animals" include:

- The company attempts to determine the safety of finished products, made from ingredients known to be safe, using in vitro and other alternatives, including the use of human volunteers.
- The company has not personally tested the product on animals but has purchased ingredients from a supplier who has animal-tested those ingredients.
- The company does not manufacture or buy any products or ingredients which have been tested on animals beyond a fixed cutoff date.
- The product and/or its ingredients have not been animal-tested within the past five years.

Here's another definition related to a specific research area—it comes from *Animals and Alternatives in Testing History, Science, and Ethics*, by Joanne Zurlo, Deborah Rudacille, and Alan M. Goldberg.

What Is an Alternative?

As the science of in vitro toxicology has grown over the past few years, some confusion has developed over the exact definition of the word "alternative" as applied to these methodologies. A replacement alternative is one that entirely eliminates the need for whole-animal testing. The limulus assay for bacterial endotoxins, in which the fever-producing potentialities of intravenous therapies are tested using the (extracted) blood of horseshoe crabs rather than whole rabbits, is one such replacement alternative. The use of in vitro systems for pregnancy testing is another.

A central notion in discussions of “alternatives” (however you choose to define the term) has been **the “three Rs.”** For background purposes, here is some history from the Johns Hopkins website:

The "three Rs"—replacement, reduction and refinement—is a movement begun in 1959 with the publication of *The Principles of Humane Experimental Technique* by British researchers W. Russell and R. Burch. In the 1980s and 1990s, this approach enabled researchers and some animal advocates to share the common goal of finding scientifically valid alternatives to tests using nonhuman animals.

Additional history appeared in the 1997 *Scientific American* article by Mukerjee assigned as reading for Dr. Silverman’s lecture on research animals in this course. Here’s the most relevant passage from that reading:

Starting in the 1960s, humane organizations and governments began to fund studies in alternative methods. European governments, especially, have invested considerable resources. For the past 15 years, Germany has been giving out about \$6 million a year in research grants alone; the Netherlands spends \$2 million a year (including overheads for its alternatives center). The **European Center for the Validation of Alternative Methods** [emphasis added], a body set up in 1992 by the European Commission, requires another \$9 million annually. In the U.S., governmental interest has been comparatively low; the National Institute of Environmental Health Sciences (NIEHS) is now offering \$1.5 million worth of grants a year, for three years. And industry provides the \$1 million a year that the **Center for Alternatives to Animal Testing (CAAT) at Johns Hopkins University** [emphasis added] disburses in grants. (Although 15 federal agencies have recently formed the **Interagency Coordinating Committee for Validation of Alternative Methods**, this venture is as yet unfunded.)

All this effort has yielded a variety of means for reducing animal use. Statistical sophistry, for example, is allowing the classical LD50 (or lethal dose 50 percent) test for acute toxicity to be eliminated. This test requires up to 200 rats, dogs or other animals to be force-fed different amounts of a substance, to determine the dose that will kill half a group. Although in vitro alternatives are still far away--because the mechanisms underlying toxicity are poorly understood--protocols currently accepted worldwide call for a tenth the number of animals. The Organization for Economic Cooperation and Development, for example, asks for between three and 18 animals to be used: if the substance kills the first three, it need be tested no further.

Another unpleasant procedure is the LD80 test for vaccines. Experimental animals are vaccinated against a disease; they and a control group are then exposed to it. The vaccine passes only if at least 80 percent of the experimental group remains healthy and if 80 percent of the control group dies. Again using statistics, Coenraad Hendriksen of the National Institute of Public Health and the Environment in the Netherlands found a way of testing diphtheria and tetanus

vaccines that requires simply checking the level of antibodies. Apart from greatly reducing the suffering, it uses half the number of animals.

"Data mining"--the sifting of mountains of information for relevant new findings--has also proved astonishingly helpful. Horst Spielmann of ZEBET, the German center for alternatives to animal testing, surveyed decades of industry data on pesticides and concluded that if mice and rats prove sensitive to a chemical, it does not have to be tested on dogs. Spielmann anticipates that 70 percent of the dog tests can be dispensed with. Klaus Cussler of the Paul Ehrlich Institute in Langen, Germany, reviewed data on the "abnormal safety test" for vaccines (called the "mouse and guinea pig safety test" in the U.S.), which involves vaccinating mice and guinea pigs and watching for untoward reactions. Their findings led to the test being dropped for vaccines checked in other standard ways. "It was so senseless," Cussler shakes his head.

In 1989, after observing that production of monoclonal antibodies in mice with tumors causes much suffering, ZEBET funded industry research into test-tube alternatives. Consequently, the antibodies, used in cancer therapy, are now rarely manufactured in mice in Europe (although mice remain the norm in the U.S.). Production of polio vaccines is another success story. In the 1970s the Netherlands used 5,000 monkeys a year; now kidney cell cultures from just 10 monkeys provide enough vaccine for everyone. Hormones or vaccines manufactured in cell cultures are also purer than those made in vivo (that is, in the animals themselves), so each batch need not be tested as before for safety and efficacy.

In 1993 the Department of Transportation became the first U.S. agency to accept in vitro tests, for skin corrosivity. The traditional test requires placing a substance on a rabbit's shaved back to see how far it eats in. The test's replacement uses reconstructed human skin or a biomembrane such as Corrositex--testimony to the role played by venture capital in finding alternatives. Several cosmetics manufacturers have entirely eliminated animal testing: they rely on in-house substitutes or use ingredients that have been tested in the past.

As yet, most researchers in the basic sciences see little hope of replacing animals. They stick to reduction or refinement, such as using an animal lower on the phylogenetic tree. The next spate of cuts in animal use, Spielmann predicts, will come in the field of medical education, for which alternative teaching tools have been devised. British surgeons, in fact, have not trained on animals since the 1876 act banned such use; instead they practice on human cadavers and later assist experienced surgeons in actual operations. In the U.S., more than 40 of the 126 medical schools do not use animals in their regular curricula. The most significant change has been in mind-set. Since 1985 in the Netherlands, every scientist starting research on animals has been required to take a three-week course. They learn hands-on procedures, proper anesthesia, specifications of inbred strains and so on--as well as the three Rs. First the students design an animal experiment; then they are asked to find ways of answering the same question without animals. The resulting discussion and hunt for information induces a new way of thinking. "It gives them time for reflection," says Bert F. M.

van Zutphen of Utrecht University, who pioneered the course. "It's of utmost importance. To know how far I can go for my own conscience."

The highlighted centers in the passage above reflect different approaches to creating high-profile discussions about “alternatives” strategies. The European effort (European Center for the Validation of Alternative Methods or ECVAM) is government-funded, while the U.S. effort at Johns Hopkins is privately funded. The U.S. government effort, which was formalized by law in 2000 and yet which (as noted at the end of this reading) some still criticize as realistically funded, is summarized at the ICCVAM website as follows:

The Interagency Coordinating Committee on the Validation of Alternative Methods (**ICCVAM**) was established in 1997 by the Director of the National Institute of Environmental Health Sciences (NIEHS) to implement NIEHS directives in [Public Law \(P.L.\) 103-43](#). This law directed NIEHS to develop and validate new test methods, and to establish criteria and processes for the validation and regulatory acceptance of toxicological testing methods. [P. L. 106-545](#), the **ICCVAM Authorization Act of 2000**, established ICCVAM as a permanent committee. The Committee is composed of representatives from 15 Federal regulatory and research agencies; these agencies generate, use, or provide information from toxicity test methods for risk assessment purposes. The Committee coordinates cross-agency issues relating to development, validation, acceptance, and national/international harmonization of toxicological test methods.

The National Toxicology Program (NTP) Interagency Center for the Evaluation of Alternative Toxicological Methods (**NICEATM**) was established in 1998 to provide operational support for ICCVAM, and to carry out committee-related activities such as peer reviews and workshops for test methods of interest to Federal agencies. NICEATM and ICCVAM coordinate the scientific review of the validation status of proposed methods and provide recommendations regarding their usefulness to appropriate agencies. NICEATM and ICCVAM seek to promote the validation and regulatory acceptance of toxicological test methods that will enhance the agencies' ability to assess risks and make decisions, and methods that will refine, reduce, and/or replace animal use.

The 15 federal agencies in ICCVAM include the powerhouses in the government research establishment such as EPA, NIH, National Cancer Institute, Department of Agriculture, and Department of Defense, Department of Energy, Consumer Product Safety Commission, Occupational

Safety and Health Administration, Department of the Interior, and Department of Transportation.

If you are interested in the work of either center, visit the websites of ECVAM, ICCVAM, and Johns Hopkins—they offer fascinating materials and studies.

Can alternatives be a WIN-WIN-WIN-WIN proposition?

Consider the following argument advanced recently (October 2005) at a seminar put on by the Massachusetts Society for Medical Research (MSMR).

- (1) In a very basic way, the search for alternatives underscores the importance, goals and methods of **science in general**. Why? Because *any* search for a scientifically valid method underscores, either explicitly or implicitly, the importance of science generally and the importance of valid methodologies.
- (2) The search for alternatives also affirms the importance of **specific research objectives**—when a particular scientific problem is being assessed, the search for alternatives as a way to solve this particular problem clearly affirms that the problem is important enough to merit careful attention.
- (3) At the same time, the search for alternatives can be used to **begin sophisticated discussions about how we should allocate precious public and private research dollars** in the most economical manner possible.
- (4) Finally, discussion of alternatives provides a **central place for the discussion of ethics** because it affirms our ability (and, some would add, our moral obligation) to protect life and cause the least harm possible.

In these four different ways, a well-framed search for alternatives might be seen in four different ways:

- a “win” for science generally,
- a “win” for the specific research project involved,
- a “win” for the budget of the institution, and
- a “win” for the importance of humans’ ethical instincts and abilities.

It is the interesting possibility of multiple “wins”, as it were, that has made the topic of alternatives the focus of both governments (for example, the European Union and the U.S. federal government) and a diverse group of private citizens that includes scientists, business managers, activists, and philosophers. Consider the unusual collection of presenters at the May 2005 conference whose program is described below.

In this conference, our own Dr. Kumar presented on “implementation of client donation programs for ethically-sourced animal cadavers,” an “alternatives” topic that has long been an emphasis at TCSVM (the effort was initiated by a student in the DVM program).

You may recognize a number of other people on this list as well. If not, here’s a little help regarding some of the other names—Tom Regan is the author of the very controversial 1984 book *The Case for Animal Rights*, which is still widely considered to be the most thorough *philosophical* treatment of the issue of “animal rights.” Animal rights philosophers and science-driven researchers don’t often appear at the same conferences—they are, in a sense, strange bedfellows.

The presenters also include a number of sometimes controversial figures who try to blend science and activism. One of the presenters listed is Marc Bekoff of the University of Colorado—he is a widely quoted and interviewed cognitive scientist who has written extensively on both play and emotions in nonhumans.¹ His work includes very explicit affirmations of science, ethics, *and* the importance of engaged activism. Some have criticized Bekoff as compromising science because his publications so regularly raise not just ethical issues, but activist-oriented perspectives as well. Another presenter at this conference was Barbara Smuts, a respected scientist from University of Michigan whose field work on primates and later dolphins has garnered much attention and respect. She has recently moved on to research on dogs, and often mixes some advocacy into her presentations.

¹ See, for example, the July 11, 2005, edition of *Time Magazine* in which an article focused on Bekoff’s recent work—the article is provocatively entitled “Honor Among Beasts—Think altruism, empathy and a sense of fair play are traits only humans possess? Think again.” Bekoff’s books range widely, as the following two examples suggest: 1997 Allen, C., and Bekoff, M. *Species of Mind: The Philosophy and Biology of Cognitive Ethology*; 2003 *Minding Animals: Awareness, Emotions and Heart*.

Because the field of alternatives attracts a wide range of scientists, philosophers, and activists, it raises interesting questions and possibilities regarding how any individual will approach “human-animal relationships.” Will science alone be the tool? Will science(s) be the leading tool, with ethical considerations brought along in some manner? Will activism be the lead approach, with science somehow subordinated? Will some other combination of approaches be used?

If you know any other scientists or activists in the following list, please mention them during our class discussion after Dr. Kumar’s talk—the human animals now chasing down “alternatives” would make up a rather interesting and diverse zoo.

The 2nd InterNICHE Conference
‘Alternatives in the Mainstream: Innovations in life science education and training’
When: 12-15 May, 2005
Where: Oslo, Norway

An exciting and inspiring event at the cutting-edge of educational innovation and practice. The only major international conference on advanced learning tools and alternatives to animal experiments in education. With leading international speakers, multimedia and virtual reality rooms, posters, discussion forum and workshops.

Suitable for teachers and students of medicine, veterinary medicine and biological science; for curriculum designers and learning technologists; for animal ethics committees, policy makers and legislators; for ethicists, animal campaigners and others committed to a progressive, humane education.

Program organisers: Nick Jukes and Siri Martinsen

Speakers to include:

- Emad Aboud, Prof. of Neurosurgery, University of Arkansas for Medical Sciences, on live surgery practice using perfused human cadavers
- M. A. Akbarsha, Prof. of Animal Science, University of Bharathidasan, on modernising biology education and replacement of dissection
- Jonathan Balcombe, Ethologist, on assessment of alternatives, and on the study of stress and pleasure in animals
- Marc Bekoff, Prof. of Biology, University of Colorado, on ethical education and the human-animal relationship
- Hans Braun, Prof of Physiology, Marburg University, on computer simulation and the link between alternatives in education and in research
- Stephen Brewster, Prof. of Computer Sciences, University of Glasgow, on virtual reality (VR) methods for veterinary clinical skills acquisition
- John Callaghan, Director of Development, WSPA, on the teaching of animal welfare
- Theo Capaldo, President, NEAVS, on the hidden curriculum in life science education
- David Dewhurst, Director of Learning Technology, University of Edinburgh, on re-useable learning objects (RLOs) and alternatives
- Nick Jukes, InterNICHE Co-ordinator, on mainstreaming alternatives for an ethical and effective life science education

- M. S. A. Kumar, Prof of Anatomy, Tufts University School of Veterinary Medicine, on the implementation of client donation programs for ethically-sourced animal cadavers
- Elena Maroueva, Veterinarian and InterNICHE National Contact for Russia, on change in Russian life science education
- Siri Martinsen, Veterinarian and InterNICHE National Contact for Norway, on policies for animal use and alternatives in education
- Makiko Nakano, Veterinarian and InterNICHE National Contact for Japan, on student outreach for alternatives in Japanese veterinary education
- Marketa Peckova, InterNICHE National Contact for the Czech Republic, on researching the use of animals and alternatives in the Czech Republic
- Monika Percic, InterNICHE Alternatives Loan System co-ordinator, on the use of loan systems to support implementation of alternatives
- Tom Regan, Emeritus Prof. of Philosophy, North Carolina State University, on academic freedom and ethics
- Adolfo Sansolini, Chief Executive, BUAV, and Vice-President, LAV, on legislation for conscientious objection and alternatives
- Garry Scroop, Prof. of Physiology, University of Adelaide, on critical thinking skills and student self-experimentation
- Sepehr Shafieezadeh, pharmacy student and InterNICHE National Contact for Iran, on replacement of animal experiments in Iran
- Dan Smeak, Prof of Surgery, Ohio State University College of Veterinary Medicine, on effective surgery training and the use of models and simulators
- Adrian Smith, Co-founder of NORINA and Prof of Veterinary Medicine, Norwegian School of Veterinary Science, on databases and implementation of alternatives
- Barbara Smuts, Prof. of Biopsychology and Anthropology, University of Michigan, on non-invasive field studies in zoology
- Thales Trez, Biologist and InterNICHE National Contact for Brazil, on networking and alternatives in Latin America
- Norwegian and Swedish virtual reality (VR) simulations for medical surgery training

Workshops on:

- * Client donation programmes and ethical dissection
- * A teacher's guide to implementation
- * Cultural obstacles and opportunities for implementation
- * Animal rights philosophy
- * Conscientious objection
- * Empowerment for campaigners
- * Experiences of connection with animals
- * The role of emotions in life science debate

Inevitable tensions? In one sense, the pursuit of “alternatives” reflects an oft-found tension in “human-animal relationships.” Humans have, of course, long been using certain nonhumans in food production, and our society today reflects in any number of ways a general acceptance of such uses—for

example, there is very broad acceptance of the increasing number of food animals consumed in the United States (about 10 billion this year).²

As we have discussed in the past, however, a different attitude prevails among both European and American publics regarding research animals. The use of research animals became prevalent in the late 19th century. In the first six or seven decades of the 20th century, use of nonhumans as experimental subjects became heavier and extremely diversified.

Yet today we find that both society and the scientific community itself have for at least 30 years reflected major commitments to minimize the number of nonhumans used—these commitments haven't appeared in every corner of the research community, but without question there has been deep concern among many to eliminate unnecessary uses of nonhuman subjects when possible.

The best known example is the IACUC oversight system in the United States which, when it is run well, regularly pushes individual experimenters to observe the “three Rs.” If you talk to today's IACUC administrators, you will learn that many scientists support this general effort, even as many others resent this kind of intrusion on their work.

You may also recall that in the readings for the research animal lecture, federal law protecting laboratory animals was cited by Bernard Rollin. He has argued often that the imposition of strict standards on laboratory animal practices is indicative of our society's changed social consensus regarding nonhuman animals generally; Rollin goes further, arguing that these federal limits embody very basic and minimal *moral* rights for nonhuman animals.³ If you visit laboratories in, for example, biotech companies or universities today, you will find that the research community itself has many who are ardent advocates of such limitations even as others in those same labs seek to limit any curbs on experimentation. The November 2005 issue of the journal *Animal Welfare* (Volume 14, Issue 4) has many articles addressing

² Not all sources would agree that there is unqualified acceptance of *any* treatment of farm animals—for example, a January 2005 survey of more than 1,800 Ohioans by The Ohio State University and the Ohio Agricultural Research and Development Center (at http://ohiosurvey.osu.edu/pdf/2004_Animal_report.pdf) found that 92 percent favored farm animals being well-cared for, and 85 percent indicated that quality of life for farm animals is important even when they are used for meat.

³ Rollin, Bernard E., *An Introduction to Veterinary Medical Ethics: Theory and Cases*, Ames: Iowa State University Press, 1999, introductory essay, especially at 48-50.

different aspects of the three Rs approach in today's complex research environment.

In summary, the area of the three Rs and alternatives generally remains a developing *and* controversial area. We'll discuss whether serious pursuit of "alternatives" reflects in different ways the compassionate side of "human-animal relationships." This softer side is, of course, easy to see elsewhere, as in the veterinary community's long-standing promotion of the human-animal bond. The emphasis on alternatives is, from some people's vantage point, of a piece with the veterinary community's emphasis on minimizing suffering.

But the story remains incomplete—as recently as the October 2005 MSMR conference referred to above, TCSVM's Dr. Karl Andrutis observed that, despite the federal policy and the commitment of many scientists, the level of interest in alternatives has not changed all that dramatically from the levels exhibited in the 1980s. Dr. Andrutis when discussing why some scientists remain skeptical about the alternatives approach suggested bluntly that "it's a cultural issue" (by which he means that in some scientific circles there remains a culture of skepticism about the subject of alternatives). One reason for the skepticism is that the general alternatives philosophy, despite being mandated by the federal government, is seen by some as inspired by the animal protection/animal rights movement. Thus, Dr. Andrutis concludes, full acceptance of the importance of alternatives remains an elusive even if desirable goal.

Further, Dr. Andrutis observed, many refinements have been developed by animal welfare scientists rather than by bench research scientists. This has resulted in many publication on this issue appearing in journals like *Animal Welfare* but *not* the journals read by the bench scientists (such as *Journal of Infectious Diseases*).

One possible reason for the failure of the alternatives philosophy to dominate may be that mentioned by Dr. Silverman in his lecture in this class—when Dr. Silverman addressed the issue of advancing the ethical status of animals used in research, he argued that "there must be adequate federal funding to make research into implementing the three Rs worthwhile to scientists." Such funding remains minimal, and advocates such as Drs. Andrutis and Silverman continue to suggest that federal dollars remain a crucial ingredient in getting the issue on the agenda of scientific conferences and into the heart and soul, as it were, of the research establishment.

The possibilities and implications of serious efforts to develop alternatives provide one of the reasons TCSVM has funded a major effort regarding alternatives. This area will, no doubt, continue to be a developing area of human-animal relationships during your tenure at TCSVM.