ASAS Centennial Paper: The future of teaching and research in companion animal biology in departments of animal sciences

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ABSTRACT: Departments of animal sciences must be relevant to a society in which a small number of people can raise almost all the food animal products needed. The declining number of people involved in animal agriculture has decreased enrollment of students interested in food animals in many departments of animal science. However, several departments welcomed students from a diverse background and began research on animals other than food animals. In many states, the undergraduate enrollment is made up primarily of students interested only in companion animals. A benefit of this is that we have recruited new students into animal agriculture and they have gone on to excellent careers. We have a new challenge now: how to maintain and expand the efforts in teaching, research, and outreach of companion animal science. Departments wishing to expand in teaching have examples of successful courses and curricula from other departments. Some departments have expanded their teaching efforts across their own university to teach about pets to a wider audience than their own majors; other departments can follow. In research, a small number of faculty have been able to establish extramurally funded projects on pets, including horses. But it will be difficult for more than a handful of departments to have a serious research effort in dogs, cats, birds, fish, or exotic animals. Departments will have to make a concerted effort to invest in such endeavors; joint ventures with other universities and colleges of veterinary medicine (or medicine) will probably be required. Funding sources for “traditional” efforts in nutrition, reproduction, and physiology are small and inconsistent; however, with the progress of the equine, canine, and feline genome projects, there should be opportunities from federal funding sources aimed at using animal models for human health. In addition, efforts in animal behavior and welfare can be expanded, perhaps with some funding from private foundations or animal-supportive organizations.

Key words: companion animal, outreach, philosophy, research, review, teaching

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BACKGROUND OF THE ISSUE: WHITHER ANIMAL SCIENCE DEPARTMENTS?

There are more than 72 million pet dogs in the United States and nearly 82 million pet cats; nearly half of pet owners considered their pets to be family members, and the average veterinary expenditure per household for all pets was $366 in 2006 (AVMA, 2007; APPMA, 2008). There were about 14 million horses, 16 million birds, 13 million reptiles, and over 150 million fish reported to be owned (APPMA, 2008). The numbers for each one of these animal groups exceeds the dairy cow inventory in the United States. About 60% of all US households own pets compared with 35% of households having children (AVMA, 2007). Total expenditures for 2007 were reported as just over $41 billion, up from twice that of 11 yr ago (APPMA, 2008). Recent statistics on pet animal ownership (Table 1) demonstrate the extent of the pet population (in the United States alone). A quote from the AVMA survey brings out a key point: “the intensity of the human-animal bond plays a central role in a pet owner’s decision to seek veterinary care” (AVMA, 2007). Market analysts of many companies have taken advantage of the strong human-animal bond to create and sustain several businesses. As an introduction to the topic of why pets are so popular, it would be of great help to research the works of Leo Bustad, a World War II veteran, prisoner of war, veterinarian, and one of the earliest students and teachers of the human-animal bond.

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In a broader context, outside of a relatively few developed countries, wide-scale pet ownership and large expenditures of money on pets is practically impossible. Companion animals are of much less importance to much of the world, where simply sustaining human life remains of utmost importance, and the thought of keeping companion animals that cannot at least fend for themselves is a luxurious dream. We might remember, lest we take some matters too seriously, what a wonderful privilege it is to enjoy a healthy human-animal bond. Then we can decide what is the proper, or possible, set of roles for departments of animal sciences in teaching (including extension/outreach) and research concerning companion animals.

The purpose of this article is not to argue the relative worth of teaching and research on companion animals versus that on agricultural animals. Rather I hope to provide some background on the topic and provide a little bit of encouragement to generate discussion among faculty, students, and research funding groups on a way forward to a future that continues to embrace all such endeavors.

Any enterprise, organization, or institution must remain relevant to its local population or larger society or culture to remain viable. For university departments, this has sometimes been a challenge, considering that the modern university in the United States is an institution only 2 to 3 generations old. To some that might seem a long time, but in many ways change in human behavior can take generations. The rapidity of technological change notwithstanding, the reader can easily refer to several cultural, regional, familial, or individual norms and beliefs that have taken many generations to change. Departments of mathematics still teach calculus that has not changed since the time of Newton, although the applications have changed, as have the methods of capturing student engagement. It is no longer sufficient for a teacher to state “Learn this for its own sake,” or “Learn this because you will have a better life.” Rather, teachers should have several answers ready to the question, “Why should I learn this?” Along that continuum, departmental faculty should seriously and routinely consider “why should we teach (or stop teaching) this?” Departments of English and literature still teach of Shakespeare, but also of modern authors and the relevance of older ones.

Should it be any different for departments of animal sciences? As specific entities, departments of “animal sciences” have only existed for 50 yr or so. The animal husbandry, dairy husbandry, and poultry husbandry departments are things of the past, and most states now have 1 animal sciences department where 2 or more existed before. In addition, many of these departments concentrate research efforts on 2 or only 1 food-animal species. The chemical, biological, and nutritional principles we teach may not have changed, the need to feed animals to their requirements may not have changed, but certainly our detail of knowledge on animals and requirements has changed. More importantly, the people that we teach and the culture in which we teach have changed in ways unpredictable 50 yr ago.

Thus, as the knowledge and applications generated by animal husbandry and then animal science departments improved our efficiency of animal production, the number of people needed to be involved in animal production has decreased (even as more people are fed). The success stories of research, teaching, and extension in food-animal production cannot be argued with. But to paraphrase friends and colleagues, in many ways, “our work here is done.” For many nutritional requirements, no further research is necessary. We can calculate, with precision better than can be practiced on farms, the energy requirement of animals (National Research Council, 1977, 1993, 2006, 2008). We have large databases on genetic traits of food animals, and in many states, much of such research has ceased. The genetic improvement of pigs and poultry has largely been taken over by private enterprise. Additionally, more faculty garner research funding for animal models of human biology. While we might not be able to, or need to, conduct further research in some areas, we still have a need to teach basic and applied biology of food species. This tension between emerging research fronts and undergraduate teaching needs has been a challenge, to say the least, for departments looking for a way forward.

The study of demographic, cultural, ethical, environmental, and economic details of changes in food animal production have been widely published and discussed (see other centennial papers) and will not be further belabored here. But how will departments of animal sciences remain relevant to human society of various regions, countries, philosophies, and cultural norms? One way is to expand our relevance to study, teaching, and extension related to other domesticated animals. These would include dogs, cats, horses, as well as several orders, families, and genera of rodents, birds, fish, sheep, and livestock.

### Table 1. Populations of companion species in the United States

<table>
<thead>
<tr>
<th>Species</th>
<th>Households, n (in 1,000s)</th>
<th>Animals, n (in 1,000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogs</td>
<td>43,021</td>
<td>72,114</td>
</tr>
<tr>
<td>Cats</td>
<td>37,460</td>
<td>81,721</td>
</tr>
<tr>
<td>Birds</td>
<td>4,453</td>
<td>11,199</td>
</tr>
<tr>
<td>Horses</td>
<td>2,087</td>
<td>7,295</td>
</tr>
<tr>
<td>Fish</td>
<td>9,036</td>
<td>75,898</td>
</tr>
<tr>
<td>Ferrets</td>
<td>505</td>
<td>1,060</td>
</tr>
<tr>
<td>Rabbits</td>
<td>1,870</td>
<td>6,171</td>
</tr>
<tr>
<td>Guinea pigs</td>
<td>628</td>
<td>1,094</td>
</tr>
<tr>
<td>Gerbils</td>
<td>187</td>
<td>431</td>
</tr>
<tr>
<td>Other rodents</td>
<td>452</td>
<td>949</td>
</tr>
<tr>
<td>Turtles</td>
<td>1,106</td>
<td>1,991</td>
</tr>
<tr>
<td>Snakes</td>
<td>390</td>
<td>586</td>
</tr>
<tr>
<td>Other reptiles</td>
<td>69</td>
<td>199</td>
</tr>
<tr>
<td>Other birds</td>
<td>464</td>
<td>4,966</td>
</tr>
<tr>
<td>Livestock</td>
<td>728</td>
<td>10,995</td>
</tr>
<tr>
<td>All others</td>
<td>1,182</td>
<td>3,664</td>
</tr>
</tbody>
</table>

1Source: AVMA (2007).
reptiles, and camelids. To illustrate a point, the number of rodents used in research in departments of animal sciences in many states exceeds the number of food animals used; from this viewpoint we are already companion animal or research animal departments.

Yet there is good reason to maintain our historical mission. Just as history departments must teach ancient history to make modern history more understandable, we have many reasons to continue to conduct research, teaching, and extension concerning food animals. But a reasonable person involved in these industries must admit that the number of people involved will not be the same as it once was; we need to adapt.

From here I will give brief remarks and ideas on the past, present, and mostly on the potential futures for teaching, research, and extension or outreach efforts related to companion animals by departments of animal sciences in the United States. When I was asked to address this topic, I knew that I was no better qualified to address this area than many others; thus, I asked previous awardees of the Corbin Award in Companion Animal Biology to share some brief philosophies and statements on this topic, and I will quote them verbatim here with a little editorial discussion. No change is ever made without root cause, and if change is to happen toward more or less effort on companion animals, such root causes must be identified and acted upon.

**TEACHING EFFORTS**

Increased teaching of undergraduate students in courses related to companion animals has already been a major change in departments of animal sciences. Several hundred students are taught about companion animals in the United States alone. According to recent university catalogs, almost all departments teach at least one course in equine science of some kind, many taught several equine courses, and a few had equine programs or minors. Most departments also taught at least one course in companion animals, separately from horses. A recent survey titled “Animal Science Perception of Companion Animals” was conducted by G. Aldrich, Pet Food & Ingredient Technology Inc., Topeka, KS, and N. A. Irlbeck, Colorado State University, Ft. Collins (2008, personal communication), in which they asked 78 departments of animal sciences to respond to a simple survey on companion animals. Results from the 23 responses indicated that 74% of the departments were teaching companion animal-related classes. Twenty-three percent of these departments (about 4) had companion animal programs. The student population was 68% female and 65% urban; 42% had a goal of a career in companion animals, 64% wanted to be a veterinarian, with 70% of those in companion animals. The departments responding were evenly split between companion animals meaning only dogs and cats and those including horses in the definition of companion animals. The responses found that 76% of departments said companion animal programs should be housed in departments of animal sciences (G. Aldrich, Pet Food & Ingredient Technology, Inc., Topeka, KS, and N. A. Irlbeck, Colorado State University, Ft. Collins; personal communication).

Our shared experiences suggest we need a presence in companion animal biology. But how, who, what, and when? Here is the opinion of David L. Harmon (University of Kentucky; Corbin Award Winner in 2005):

“The inclusion of information on companion animals is critical to the long term sustainability of the animal sciences as a field of education. Animal sciences arose as a core component of the land grant mission. This mission has been to promote research and education towards improvements in animal husbandry. This mission has been a highly successful one. However, changing demographics dictates a reduced demand for this mission. Fewer of our clientele are interested in production agriculture. However, an ever increasing number are interested in animal science. They are interested in the species they grew up with, and are most familiar with. This is an opportunity for animal scientists. By broadening our focus to include companion species we can increase our support, broaden our mission, and sustain animal science. The majority of programs will address these needs via increased instruction in these areas. The costs associated with research infrastructure and limited opportunities for funding will limit the number of research programs. However, the demand for individuals with graduate training with companion animals will remain high.

Now can be an opportunistic time for animal science. Too often the choice is to avoid change. I suggest we should consider how we can best sustain ourselves as a department, as a society. How can we address more species and grow our mission? One possibility would be to consider not only production agriculture as our mission. Adopt a mission to embrace companion animals and laboratory animals as components of this mission. There is both an opportunity and a need.”

I certainly have no argument with these thoughts. While demographics alone do not dictate a complete change of mission for university departments, faculty must consider seriously how they should adapt to changing demographics. David Harmon, along with many others, has taken on the challenge of re-tooling in order to teach relevant content to the present students.

From Anita Oberbauer (University of California-Davis; Corbin Award Winner in 2004):

““Companion animals” encompassing working animals (farm and service) to those animals strictly owned for their role as a companion, must be an integral component in the 21st century animal sci-
ence departments both at the research and curricular levels. Insight into the physiology, genetics, nutritional, endocrine, and immunologic processes of companion animals can be applied to all species—livestock as well as human, complementing existing discoveries thereby advancing science more rapidly. Our companion species, with their generations of selection, offer tremendous models for growth, disease, and nutrient utilization. Further, given the trend toward fewer rural students in the animal science major, incorporating companion animal species into the animal science curriculum exposes these urban students to the needs and practices of animal agriculture while retaining the students’ interest with species they are familiar with.”

Anita Oberbauer teaches 2 highly regarded classes on companion animals at the University of California—Davis, which is certainly a fine example of adapting to changes in society. From Marshall Stern (University of Minnesota; Corbin Award Winner in 2006):

“Demographics of students have changed such that the majority of students in many animal sciences departments are now women, come from urban backgrounds, and target advanced study…as goals. . . . These characteristics often reflect…primary animal experiences and interests are with companion animals.”

Stern notes the same trends we all have and he also took on the challenge, from an already outstanding career in research and teaching, to branch out and meet modern needs. Many departments have already adapted to the reality of the student population and changes in society demographics. There are some good texts available to those just starting out and wanting some reference information or texts for class (Case, 1999; Case et al., 2000; Hand et al., 2000; Warren, 2002; Cheeke, 2003; McNamara, 2006; Campbell and Campbell, 2009). But what now? Each departmental faculty needs to get some serious information from their state or region, and based on their experience, decide to expand (or contract) course offerings or outreach activities. They need to discuss potential sources of funding. They need to discuss, openly and across departmental lines, what is best for their students and university? Can they cooperate with biology or zoology departments, or the college of veterinary medicine to offer courses that are soundly based in biology and related to companion animals?

Several departments have classes with “animal welfare” in their titles; such classes discuss the usual (and important) issues such as cage size and tail docking/beak trimming in animal agriculture. But who is giving the students a basic and applied grounding in pet ownership and companion animal biology and management, including welfare and rights issues? Who is discussing pet overpopulation or the issue of using food available for humans or food animals for pets? Who discusses the issues brought up by the People for the Ethical Treatment of Animals or the Humane Society of the United States philosophies on pet ownership? The issues of letting horses overpopulate the American West or killing them for human consumption elsewhere? If we fail to provide students with some scientific background and critical reasoning skills, then others will come in with political or philosophical arguments that can lead to political action that makes a situation worse. One might argue that “that’s not our job,” “that’s too political,” or “there’s no winning those arguments.” I am not suggesting that departments of animal science teach core courses on philosophy, but if we are not directly involved with training students on the philosophical issues surrounding companion animals as well as food animals, someone else will be.

One example of the possibilities can be found in the course taught at Washington State University (Pullman): Animal Sciences 464, Companion Animal Management. It is a senior-level class, requiring some biology, nutrition, genetics, and statistics as prerequisites. In the 1970s, this course was Nonruminant Nutrition, the advanced class for poultry, pigs, and horses. In the late 1980s and 1990s, we included more on horses, cats, dogs, and then birds, fish (first poultry and aquaculture, then ornamental birds and aquarium fish). Eight years ago we removed most aspects on agricultural animals, and 4 yr ago expanded “nutrition” to include other areas of companion animal management. The goals and outcomes of the course include a grounding in the principles used in the care of companion animals, including pet selection, sound breeding, nutrition, training, and financial and environmental management; the ability to apply this understanding to improve the well being of our companion animals; the ability to understand critical concepts and to solve problems in aspects of companion animal management including animal selection, breeding, diet, behavior; an appreciation of the societal development of animals as companions; and to apply computer-assisted analysis and problem solving programs, including spreadsheets, Internet systems, database programs, knowledge bases, rule bases, and expert systems to solve practical problems of animal care. The expanse and interaction of the topics is exemplified in a concept map (Figure 1) that the students develop early in the class to explore the vast number of disciplines and areas of human activity connected to animals. From that “mind game” they proceed to specifics: pet overpopulation; genetic diseases caused by inbreeding; nutrition and care; responsible pet ownership decisions; and other such social topics. I think it is important, especially in a senior-level class, that students are challenged to recognize and address the wide scope of human activities relating to companion
animals. They will be the ones dealing with the economic, social, and political decisions regarding companion animals in the future.

For the culminating activity of this class, students have to choose a companion animal topic to research, submit, revise, and develop into a computer-based teaching module. The students have chosen a diverse range of topics (Table 2; student ownership of education) that are grounded in proper scientific methodology (proper subject matter content) and include issues discussed by veterinarians, city councils, and state and federal legislatures (course relevant to society). The students must develop a clear stated objective for the module, include sufficient background material in their own words, have quantitative data from refereed literature (they have to summarize and graph information that is quantitatively correct and scientifically defendable), and present this to others. This exercise truly is a capstone experience, bringing genetics, biology, nutrition, statistics, as well as philosophy, political science, and economics together. Most would agree that such a course is appropriate for a department of animal sciences, and in fact, there are only a few such senior-level courses in companion animal management offered. However, the course is well-received by most students for the critical analysis skills they develop, is relevant to the issues they deal with and are interested in, and fulfills a need.

Arguments sometimes used against expanding efforts in companion animal topics include "where are the jobs"? and "what will they do with that"? These are valid questions, but in most states, many students taking food animal management classes do not go into dairy, beef, or swine management careers, yet we continue to teach those classes, and I think they are justified. Similarly, why shouldn't departments of animal sciences also be the leaders in exploring and teaching about the relationship of humans to companion as well as food animals?

**RESEARCH EFFORTS**

There has been a long, rich, and effective history of research on companion animals in departments of animal sciences, far beyond the scope of this article. A brief
A search of just the *Journal of Animal Science* yielded approximately 1,116 articles published on dogs, 1,045 on cats, and 1,829 on horses. Much of the nutritional knowledge we have today, certainly on horses, has come from research in departments of animal sciences, much of it in cooperation with colleges of veterinary medicine. It is likely that research into aspects of companion animal biology will continue, but it is unlikely there will be large-scale expansion. Competition for federal scientific agency funding will continue to increase, and a scenario in which Congress approve significantly more money for research on pets is hard to envision. Private companies will be pressed to save money as feedstock and fuel prices continue to increase.

I asked George Fahey (University of Illinois, Urbana) to provide some comments on the future of research, and part of his reply follows:

“It is VERY expensive to develop the infrastructure to conduct companion animal work. Unique housing accommodations are necessary and many academic units simply would not have the financial resources to build them.

“The animal activists are very much opposed to research on cats and dogs, and they are a thorn in the side of many of us who work with these species. Old guys like me can usually ignore their nonsense, but younger scientists may be a little ‘thinner skinned’ in dealing with them. You may or may not want to introduce this in your paper, but it’s a reality.”

I certainly agree with these comments. The cost of infrastructure and maintenance of facilities for dogs, cats, and horses is tremendous. Barring some large private foundation deciding to befriend their alma mater, it is not likely to happen. A vocal portion of society is also against animal research yet many more would like solid information on health and nutrition of dogs, cats, and horses, beyond what colleges of veterinary medicine have done or can do.

Yet these serious concerns should not be reasons to wave away efforts in companion animal research (“It’s not important!” “It won’t bring in the big bucks!” “It costs too much!”). Possibilities abound with potential related to study of genetic interactions with disease, longevity, behavior, and utility of animals. The Canine Genome project (and the equivalent equine and feline projects) may open up new areas of research just beginning to be probed (Parker et al., 2004; Leeb, 2007; Calboli et al., 2008; Spady and Ostrander, 2008). Examples already exist with the work done at University of Illinois on the interactions of gene transcription, diet, and longevity (Swanson et al., 2003). Research using dogs, cats, and horses as models of human disease has strong precedent and in the right atmosphere can be expanded (Tsai et al., 2007; Wayne and Ostrander, 2007; Vainzof et al., 2008).

Private companies will likely continue to fund some in-house and collaborative research on focused areas. Privately funded work on the antioxidant potential of specific fatty acid classes has been a major research success story. I remember teaching during the late 1980s and 1990s about this new area of “omega-3” fatty acids and inflammation, first arising in veterinary prescription diets for hypersensitive animals, and on the role of β-carotene in inflammation (Hand et al., 2000; Chew and Park, 2004). Now we teach about the biochemistry of omega-3 and omega-6 fatty acids and inflammation.
and the mainstream use of fish oil, docosahexaenoic acid, eicosapentaenoic, and carotenoids in supplements and diet formulations to reduce inflammation (Chew and Park, 2004; Wolowczuk et al., 2008). The work on carotenoids done by Boon Chew (the first Corbin Award winner) was supported in large part by private enterprise (Chew and Park, 2004). Thus, from an interesting new research area, the role of different fatty acids in eliciting or suppressing major changes in immunity and inflammation have developed into proven and accepted nutritional modalities. In many areas, we now have solid evidence of the interaction between genetics, diet, fatty acid metabolism, inflammation, disease, and longevity. This area of research was not opened up only by pet-food companies, but certainly their pioneering work helped bring this major health finding into focus.

One more example of research success stories is that of using the horse as a comparative model in human glycogen storage myopathies. From the old days of studying “tying up” or “blackwater disease” in farm horses (Hintz and Cymbaluk, 1994), we have progressed into many studies into the genetics and physiology of polysaccharide storage myopathies (Annandale et al., 2004; Geor, 2005). Some of these metabolic diseases of the muscle in horses are similar to those occurring in humans. Some specific lines of horses do not express the correct enzyme suite to form or break down glycogen in the muscles, leading to moderate to severe (or fatal) cellular damage (Geor, 2005). There is a fair understanding of the genetic background, environmental influences, practical rations, and management schemes to minimize damage (Annandale et al., 2004; National Research Council, 2008). This is another good example of using companion animals to conduct research in problems relating to the animals themselves as well as models of human disease. What is the next research forefront waiting to be found in dogs, cats, or horses?

WHERE IS THE WILL BEFORE WE FIND THE WAY FORWARD?

The will to move in a certain direction must precede the means and mechanisms. Businesses routinely perform some sort of needs assessment before committing to an activity or product. It might run from “I think a lot of people would buy this” to a full-scale objective third-party market survey. University departments tend to be closer to the former in most activities, but they usually note trends in employment, student interest, or research funding before justifying and making serious commitments. Certainly, the data presented here and the changes in society in the last 50 yr can justify continued, if not expanded, efforts in teaching, research, and outreach related to companion animals.

However, the old saying “societies have problems, universities have departments” certainly applies. Resistance to change, protection of “turf” (fear of loss of autonomy or philosophical or financial control), and valid concerns about funding all lead to a feeling of “it can’t be done.” But departmental faculty must discuss with outside people and organizations involved in companion animal efforts, with their students, and then among themselves to come to the right decision for their state and region. Increased interest in all the topics discussed above is reason enough to have a strong undergraduate curriculum. There is certainly employment to be had in several endeavors related to pets to justify continued efforts in an undergraduate curriculum. There are employment opportunities for advanced students in some areas (research, government oversight, and teaching) of genomics, nutrition, reproduction, ethology, welfare, animal health, and public health to justify some training of graduate students.

There could be, in some states and regions, sufficient justification and support for outreach efforts. For example, the University of Illinois and Iowa State University have already expanded in this arena. Certainly, there is a large population in the United States, usually in urban or suburban areas, that has a tremendous interest in pets. Most extension-type activities have been filled in by the local veterinarian, some local animal shelters, or private individuals. There is great potential for working with youth through existing 4-H personnel. Many youth do pet projects and this provides an opportunity for departments of animal sciences to be relevant in expanded areas. The needs for outreach activities can be justified in many states, but, in my opinion, the political will and therefore the funding is not there. Obviously, society has many problems and issues that are higher on the priority list for state legislatures and governors. Yet in some cases it might be possible to expand efforts in companion animal outreach activities. Animal science faculty would be well grounded in basic and practical biology and economics and would provide sound information to people. Outreach activities with youth interested in companion animals could be a good recruiting tool for increasing student enrollment. In this case, departments would need to have a good plan to provide an appropriate set of course offerings and career counseling to serve those students. But departments must conduct an objective investigation and reach a consensus before expanding course offerings and certainly before hiring faculty.

Some future endeavors in companion animals and reasons for them have been discussed. My intention was not to make a blueprint for animal science departments on this topic. Details change yearly and vary from region to region. For example, recent changes in energy and food availability and costs will be of serious interest to pet lovers worldwide and almost certainly put a downward pressure on pet ownership; the same may happen to animal agriculture. A downward trend (certainly in poultry and pork and in grain feeding to cattle) may already be starting. These are not reasons to cease forward movement as a science or set of uni-
versity departments. Rather, I hope I have encouraged discussion and development of the needs and the will; once that is done, the way will be found.

**LITERATURE CITED**


