

# Perspectives in Professional Education

## Functions of veterinary colleges and orientations of professional practice in the Americas

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Research, teaching, and extension functions of academic institutions can be viewed to correspond to functions that characterize knowledge systems, such as the generation, dissemination, and utilization of information.<sup>1</sup> A holistic paradigm to evaluate functions of veterinary colleges and orientations of professional practice would require that data be provided on generation of new information (the research function), dissemination of new information (teaching and extension), and utilization of new information (professional practice). In addition, theory indicates that measurements of the environment surrounding a knowledge system may be used to determine whether the system meets the needs of the environment.<sup>2</sup> An assessment of potential societal needs for veterinary expertise may complement a holistic evaluation of veterinary knowledge systems. The study reported here assessed func-

tions of veterinary colleges, which have developed on historically based perspectives that may have influenced the institutions under study.

### Materials and Methods

Qualitative and quantitative<sup>3</sup> research methods were chosen for the study reported here. Qualitative methods<sup>4</sup> included analysis of curriculum content and orientation of professional practice as reported in course catalogs and documents provided by the authors and by the Pan American Health Organization. Quantitative data were elicited by means of a survey on academic expertise reported elsewhere<sup>5</sup> and by use of a search of bibliographic references between January 1972 and June 1995 that was compiled from an agriculture database,<sup>6</sup> using extension as the major keyword.

### Results

**Development of historical models**—Four models may have historically influenced veterinary medical education in the Americas.

**Medieval model**—European universities were established at the end of the 12th century,<sup>b</sup> becoming the first model whose influence can be traced historically to the undergraduate education of liberal arts students. They provided instruction in 4 disciplines, including law, medicine, theology, and arts. This model was initially introduced in the Americas in the Spanish colonies and, subsequently, in the British colonies.<sup>7</sup>

**The Napoleonic-Latin American model**—After the French Revolution, universities in France were closed. During the early 19th century, Napoleon established a university model, which provided separate schools for each profession that were designed to serve specific needs of the state.<sup>8</sup> Veterinary medical education was established within this multiprofession model to support the needs of the cavalry. The role of horses in transportation, not the use of animals as food, was the driving force of the professionalization of veterinary medicine.<sup>9</sup> The Napoleonic-Latin American model introduced the concept that higher education might provide professional training in areas other than law and medicine. Although some universities had existed in Latin America since the early colonial period, they did

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not play an important role in the promotion of scientific training.<sup>7</sup> Instead, the Napoleonic professionalist model was massively adopted by Latin American republics after they became independent from European countries. Similar to the university in France, new universities in Latin America were established in the national capital of each country to best serve the needs of the state. Schools of veterinary medicine were created around the end of the 19th century. They were inserted within a model characterized as a loose federation of separate schools that did not share facilities or course work.<sup>7</sup> Similar to the Napoleonic professionalist model, the concept of a campus was lacking. Although teaching was emphasized, research was not. In France and Latin America, universities offered a single type of academic degree until the 1950s. The first degree equivalent to the PhD was awarded in France in 1954.<sup>10</sup>

**The German model**—A new model was developed in Germany with the creation of the University of Berlin.<sup>c</sup> Wilhelm von Humboldt, its originator, added research to teaching. Thus, Germans began to include in their teaching what they had investigated.<sup>8</sup> The emphasis on research was implemented by dividing the medieval discipline of theology into theology and philosophy. Philosophic research resulted within a few decades in an unprecedented process of disciplinary differentiation. People possessing a PhD advanced new fields of science such as organic chemistry. Research performed for the sake of gaining knowledge produced information that was applied to solving problems. The novel science of chemistry helped to develop agriculture (fertilizers) and new industries (pharmaceuticals).

**The land grant model**—By 1862, the United States realized that Germany, a small, poor country with a large rural population, had been able to prosper in agriculture within half a century because of its academic emphasis on scientific research. The United States also realized that British industrialists were becoming prosperous as a result of their machinery. Because programs offered at that time by US universities were not appropriate for agricultural or engineering development, the US Congress passed the Morrill Act (Land Grant Universities Act), which secured financial resources for development of agriculture and mechanic arts.<sup>11</sup> The land grant model drew on the German model and promoted research, but it also expanded the German model by emphasizing the application of new scientific information. The focus of the Land Grant Universities Act on agriculture resulted in a multidisciplinary approach to teaching and research. Because knowledge had to produce useful results, this model added a third academic mission, extension.<sup>7</sup> This model broke the professionalist orientation of previous models that had focused on training for the needs of learned professionals (physicians and lawyers) and, instead, created multidisciplinary programs according to the needs of those of a particular field (such as agriculture), rather than the needs of those in a particular profession. Although the disciplinary boundaries of agriculture were not clearly demarcated, promotion of applied research enabled new areas to emerge, which promoted further disciplinary differentiation. According to Havelock's

theory,<sup>1</sup> this evolution can be seen as an emphasis on knowledge dissemination (teaching) in the first 2 models, added emphasis on knowledge generation in the German model, and an additional emphasis on generation and dissemination of knowledge for immediate use in the land grant model of applied research coupled with extension.

When the first colleges of veterinary medicine were created in the United States between 1879 and 1899,<sup>9</sup> the land grant model already had been consolidated. In the land grant model, fields shared in other countries by veterinary medicine and agriculture (eg, animal science) remained predominantly in the domain of colleges of agriculture. Contrary to the Latin American experience, US veterinary colleges usually were annexed to land grant university campuses, which facilitated intercollege communication. Thus, although veterinary colleges were introduced after agricultural disciplines took shape, veterinary and agricultural colleges often shared facilities, course work, and faculty members. Organizational and physical reasons prevented some Latin American veterinary colleges from such collaborations with agricultural colleges.

**Research expertise**—Of 348 surveys that were sent to faculty members of 4 veterinary colleges of the United States and Canada, 131 (38%) responses were received. Respondents indicated a strong emphasis on research and professional specialization. Eighty-seven of 131 (66%) faculty members had postgraduate training (minimum per college, 12/31, 39%; maximum per college, 36/47, 77%). In contrast, 274 of 637 (43%) responses were received from faculty members of 6 Latin American veterinary colleges. Those respondents indicated that 38 of 274 (14%) faculty members had PhD degrees (minimum per college, 2/46, 4%; maximum per college, 8/30, 27%).

**Scope of curriculum**—Professional curriculum seemed to be broader in scope in veterinary colleges in Latin America than in veterinary colleges in the United States or Canada. In addition to clinical training, nonclinical training (eg, food safety, public health, herd medicine, food science, hygiene of foods of animal origin) was included in the curriculum of many Latin American veterinary colleges. For instance, food- and animal science-related disciplines constitute about a fourth of the professional curriculum at the Faculty of Veterinary Sciences of the National University of La Plata, whereas those disciplines represented only about a tenth of the curriculum at the College of Veterinary Medicine of North Carolina State University. The domains of food and animal sciences usually belong to colleges of agriculture in universities in the United States and Canada.

In contrast, veterinary colleges in the United States and Canada usually emphasize clinical training. Elective courses and combined DVM/PhD programs offer additional training in multidisciplinary scientific issues that require veterinary medical expertise.

**Extension research**—From January 1972 to June 1995, 21,147 publications were identified by means of a keyword-based search, using the word extension. Ex-

tension publications that also had the keyword veterinary represented 1% of the total. Articles published in the Americas from 1993 to 1995 represented a tenth of all veterinary-related extension publications, which was 0.1% of all extension publications. Compared with agriculture, veterinary sciences appear to lack scholarly research in various areas of extension work (eg, dairy, beef, poultry). Even in areas in which major veterinary medical knowledge seems to be required (eg, dairy extension), contributions by nonveterinary extension researchers outnumber veterinary contributions.

**Orientations of the veterinary profession**—Analysis of documents indicated that there were 4 colleges of veterinary medicine in Canada, 27 in the United States, and 126 in Latin America.<sup>9,12</sup> Approximately 55,000 veterinarians worked in the United States in 1993,<sup>13</sup> whereas 70,000 veterinarians were employed in Argentina and Brazil, and more than 100,000 veterinarians were employed in all the Latin American countries. Brazil and Mexico each have more colleges of veterinary medicine than the United States and Canada combined. Colombia and Argentina each have 8 veterinary colleges. Some Latin American countries have up to 4 times more veterinarians per the number of people in the general population than the United States and Canada. By 2000, Brazil expects to have more than 65,000 veterinarians. Greater numbers of livestock per the number of people in the overall population and broader professional responsibilities (eg, animal science, food safety) are factors associated in some Latin American countries with this amount of professional development.<sup>14</sup>

In the United States in 1993, more than 60% of practicing veterinarians worked in small animal or equine practices, whereas only 4.5% worked in large animal practices (8.1% of practicing veterinarians were employed in all food animal practices, including those that cared for poultry and swine).<sup>13</sup> These numbers were representative of a rather undifferentiated and unipersonal professional practice, because most clinics were operated by only a single veterinarian.<sup>9</sup> Many aspects differentiate veterinary medical practice from that of human medicine. For instance, human medicine is typically covered by insurance. It should be noticed that approximately three fourths of the physicians in the United States hold specialty or postgraduate degrees, but it is estimated that less than a tenth of practicing veterinarians in the United States hold postgraduate or specialty degrees. Thus, most veterinary practitioners do not provide a service as specialized as available science and technology might allow. It also has been indicated in a national report that clinical professional veterinary practice is already overstaffed.<sup>9</sup> Although data were not available regarding practice orientation of veterinarians in Latin America, it was assumed that the curricular focus on nonclinical medicine would be reflected in actual practice.

**Needs assessment**—Reports of food safety investigations reveal that between 24 and 81 million people develop diarrhea in the United States each year as a result of foodborne diseases.<sup>15</sup> Economic losses attrib-

utable to foodborne diseases in the United States alone range from \$1 to \$10 billion each year. Salmonellosis accounts for losses estimated between \$0.74 and \$1.2 billion each year.<sup>16</sup> Researchers in food-production medicine indicate that mastitis in cattle results in losses that are estimated at \$160 million each year<sup>17</sup> for New York state alone, and losses attributable to mastitis in cattle for the entire United States are estimated to be \$2 billion annually.<sup>d</sup> In turn, losses attributable to livestock diseases are probably greater among Latin American countries. Losses caused by foot-and-mouth disease exceed \$500 million annually, and brucellosis causes losses of more than \$600 million each year.<sup>18</sup>

The lack of optional training in food safety in the curriculum of most US veterinary colleges has required the USDA to provide additional training for veterinarians who are involved in meat and poultry inspection.<sup>e</sup> In 1982, training in the field of food safety was estimated to be needed by 3,000 professionals and by 23,000 nonveterinarian inspectors in the Americas (excluding the United States). By 1987, those training needs were still unmet.<sup>19</sup> New requests for public health veterinarians in US cities of 300,000 inhabitants or more may create a demand for which new training programs may be necessary.<sup>20</sup> In Latin America, a broader curriculum content and an emphasis on quantitative expansion of the veterinary workforce did not seem to be supported by research or by postgraduate training of faculty bodies.

## Discussion

**Assumptions and limitations**—The study reported here did not test hypotheses regarding actual functions of actual colleges. Given the limited sample of veterinary colleges, compared with the entire population of veterinary colleges in the Americas, the limited number of respondents received from each of the colleges (eg, data on faculty graduate training typically were provided by less than half of active faculty members), and the limited number of course catalogs examined (2 from schools in Latin America and 3 from schools in the United States and Canada), data should be considered with caution. In addition, bibliometric data may have been influenced by the number of people in various veterinary and agricultural academic communities. However, the data provided by this study may generate theories that will require further testing.

**Historical models**—Retrospective analysis of higher education models would suggest that, since the 19th century, 3 phases of knowledge-driven societal development were characterized by new qualitative or conceptual definitions of higher education, each of which was followed by a period of quantitative growth. The Napoleonic-Latin American model introduced the concept of professionalization (training according to types of employment that were regarded as necessary) and grew in number of students wishing to qualify for those professions. However, other types of employment that were not emphasized at that time remained beyond academic consideration. Thus, the limit of this model

seemed to be determined by the extent of professions included in higher education and the number of jobs available in those professions. Beyond that limit, overproduction of graduates could lead to saturation and professional unemployment. This model may be regarded as a profession-centered model.

The German model introduced the concept of disciplinary differentiation driven by research. By expanding the knowledge base, regardless of professional considerations and, sometimes, even practical applications, the newly generated knowledge helped to solve problems and was used in the development of new educational programs. The limits of this model appeared to be set by the acceptance of new disciplines by people trained and employed in the preexisting disciplines and by organizational characteristics such as the need for individuals to master an entire discipline to be appointed to professor status. When conflicts arose between the established disciplines or knowledge was too vast for 1 person to remain updated, this model could not continue its evolution.<sup>8</sup> Thus, it may be described as a discipline-oriented model.

The land grant model introduced the concept of problem solving. Training for the professions was not a concern. Research was viewed as an instrument, not as an end. By focusing directly on needs, it helped to develop new knowledge, disciplines, and professions. However, the limits of this model seemed to involve the conceptualization of its focus. For instance, whatever was not regarded as belonging to agriculture was not emphasized. It did not seem to reward long-term outcomes or processes. Thus, it seemed to be a short-term, product-oriented model.

All the models were not planned, but were developed in response to historical situations.<sup>7,8</sup> In contrast to when these historical educational models were originated, scientific information currently grows at a rapid pace. Thus, it is postulated that the interdependent relationships between newly generated information and the effects of organizational designs on research, teaching (including faculty development and continuing education), and practice need to be constantly assessed.

**Paradigms of academic and professional practice**—Two paradigms of academic veterinary medicine were suggested by analysis of the data. A Latin American paradigm was characterized by weakness in research expertise, broad curriculum content that included education in animal sciences and economics, and professional practice oriented toward agriculture and public health. A Canadian-US paradigm was characterized by strength in research expertise, narrow curriculum content, and professional practice oriented toward small animal, food animal, and equine practice. Both paradigms lacked research in veterinary extension and other social sciences (eg, economics).

These paradigms appeared to be explained by historical factors. The Latin American paradigm resembled its Napoleonic professionalist origin. It emphasized teaching more than research. Lack of training in research affects generation of new biologic knowledge, but also knowledge about the relationships among disciplinary contents, orientations of professional practice,

and socioeconomic needs. The Canadian-US paradigm, according to the land grant model, placed various disciplines and fields of practice outside its domain. Animal science, food safety, economics, and extension historically have been integrated into colleges of agriculture. The focus of these colleges has been nonveterinary agriculture. Latin American and Canadian-US paradigms lack components in the social sciences. As indicated by the paucity of research reported for areas such as dairy, beef, and poultry extension, social sciences have been important components of nonveterinary agriculture (eg, communication, extension, education, economics), but have not been developed in veterinary medicine.

**Previous studies and alternative paradigms**—Our findings may be analyzed within the context of previous reports. In the 1989 Pew Foundation Report on veterinary education, the authors emphasized the need for a shift from a universal, clinical focus on professional practice toward a preventive, animal health focus. The authors also recommended closer ties with animal science programs.<sup>9</sup> This recommendation is in line with similar considerations that arose in human medical schools many decades ago, which resulted in the creation of study programs in public health.

The Pan American Health Organization, in turn, has produced an extremely compelling report indicating the need for diversified training in Latin American colleges of veterinary medicine, so that multiple needs of people in the fields of veterinary or animal health, as opposed to clinical practice dealing with a single animal, can be addressed.<sup>12</sup> Although the field of animal health is considered in Latin American colleges, most do not offer elective courses or postgraduate research training. In contrast, some US schools of public health offer a dozen distinct study programs in public health, consisting of about 400 courses.<sup>21</sup>

Study and research programs in public health provide a prototypic institutional model that could be considered by veterinary medicine. In 1916, Johns Hopkins University created the first school of public health in the United States. Derived from a medical school and using an approach toward public health that was similar to the approach advocated by the land grant model toward agriculture, it targeted multidisciplinary health needs by focusing on issues, rather than on particular disciplines or professions. Thus, it brought together multiple disciplines that currently include biomedicine, behavior, social sciences, and mathematics. Diverse fields are integrated, such as molecular biology, epidemiology, policy formulation, statistics, organizational development, long-distance education, health economics, and mathematical modeling.

Realizing that training of medical doctors was not enough to solve human health problems and that preventing disease was most economic and effective in improving the quality of life, the public health model promoted integration of research with practice, regardless of a priori professional definitions. The public health model offers a flexible and diverse study program that can be integrated with clinical professional education. Although medical schools experienced a

major organizational and disciplinary change because of the public health model, the programs developed by some veterinary colleges (Texas A&M University, University of California-Davis) have not reached national or international scale.

Analysis of results of the study reported here was used to explicate paradigms of veterinary academic and professional practice in the Americas on the basis of an evaluation of implicit functions of veterinary knowledge systems, as defined by profiles elicited by an assessment of knowledge generation (research expertise), dissemination (curriculum content, extension expertise), and utilization (orientations of professional practice, social needs). Empirical findings were on the basis of a historical context and were compared with the implicit disciplinary contents of other models of higher education (agriculture, public health). The combined analysis suggested potential imbalances, including emphasis on teaching, but not research, failure of current training programs to meet perceived needs, lack of research expertise in social sciences, and incomplete conceptualization of the highest-level category (agriculture divided into nonveterinary- and veterinary-related agriculture).

Our findings could provide a guide for academic and professional development. Given the relatively small number of members in the veterinary academic and professional community, compared with the agricultural and human health communities, we suggest that efforts leading to a greater integration within the larger university community and with other professional communities may facilitate veterinary academic and professional development. For example, collaboration in the social disciplines (extension, economics, communication, evaluation, education) with colleges of agriculture may facilitate joint research, teaching, and service in veterinary-related areas (eg, food animal production medicine, international education). Participatory extension methods developed in agriculture may facilitate identification of research needs and application of new veterinary technologies that could be integrated for use by farmers and veterinary practitioners.<sup>22</sup> Expertise developed in organizational development, economics, and policy analysis may be applied to academic strategic planning. Utilization of social science conceptualization and evaluation of research methods may help define the focus, processes, and means necessary for a complete and integrated consideration of complex problems. For instance, the scarcity of veterinary inputs in dairy extension literature would suggest that the rapidly growing biomedical knowledge base in areas such as clinical pathology, immunology, and molecular biology may be underutilized in the resolution of problems by dairy extension personnel.

Collaboration with schools of public health may enable the development of projects that integrate veterinary expertise in animal diseases with molecular epidemiology, behavioral sciences, and mathematics. Collaborations with schools of public health and colleges of agriculture may integrate research on human foodborne disease and food safety with veterinary aspects of food animal production medicine. Experiences accumulated through use of these academic models

may be used to increase the number of people in the student body through computer-based, long-distance, continuing education programs for domestic and international part-time students.

Teaching and research programs also may emphasize particular needs of potential users of veterinary expertise such as farmer cooperatives, industries, and government agencies. The focus would be on knowledge utilization. For instance, customized programs may be developed to meet interdisciplinary, multiprofessional needs of a particular client, which are presumably not met by discipline-oriented, department-oriented, or profession-oriented programs. Multipersonal training, although time consuming in the planning stages, might lead to faster overall application of knowledge of trained individuals, greater impact on client's needs, and development of new interprofession specialties.

Analysis of results of holistic study of functions of veterinary knowledge systems, composed of academic, professional, and clientele components, indicated profiles explained by historical factors, rather than scientific and functional factors. Two paradigms were developed on the basis of the data and appeared to be centered in a disciplinary configuration or a professional configuration, respectively. Although 1 paradigm did appear to be broader (given the current growth of research and diversification of scientific fields), it was considered unlikely that any disciplinary configuration could achieve lasting self-sufficiency without increasing integration within the larger academic community and placing greater emphasis on research training. On the other hand, focusing on meeting short-term professional clinical demands may result in saturation of some professional markets. It is suggested that alternative models that simultaneously consider interdisciplinary and intercollege integration with the needs of potential users of veterinary expertise and that focus on processes rather than short-term products may facilitate academic and professional development.

<sup>a</sup>CAB abstracts (agriculture).

<sup>b</sup>The process of creation of universities was gradual and spanned several centuries. Often, there is disagreement on when or what can be described as the first university. However, many historians agree that the University of Bologna in Italy was the first university in Europe. The University of Bologna, the University of Paris, the University of Oxbridge (universities of Oxford and Cambridge), and a few other universities represented the medieval model.<sup>6</sup>

<sup>c</sup>Although the University of Berlin was established in 1810, laboratory-centered, research-oriented universities did not emerge in Germany until between 1825 and 1870.<sup>8</sup>

<sup>d</sup>González RN, Quality Milk Promotion Services, Diagnostic Laboratory, College of Veterinary Medicine, Cornell University, Ithaca, NY: Personal communication, 1995.

<sup>e</sup>Almeida C, Food Safety Program, Pan American Health Organization, Washington, DC: Personal communication, 1994.

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