

# Envisioning the Future of Veterinary Medical Education: The Association of American Veterinary Medical Colleges Foresight Project, Final Report

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## ABSTRACT

This report of the Association of American Veterinary Medical Colleges' 2006 Foresight Project, developed under the leadership of an AAVMC Steering Committee, drew on the experience, imagination, and energetic participation of more than 95 participants from across the United States and Canada.

The environment of veterinary medicine is one of profound change. The current number of veterinarians is inadequate to address the present and future needs of society. To remain relevant, academic veterinary medicine must prepare veterinarians for what may come in the future. In order to be recognized and remunerated for their knowledge, compassion, integrity, and judgment, veterinarians must first demonstrate their relevance to new societal trends.

The objective of the study reported here was to determine a future direction for academic veterinary medicine using Foresight technology. The tools employed were challenge questions and the development of eight future possible scenarios. The study supported the need for change. This report recommends an adaptive and responsive system of veterinary medical education, achieved by defining those areas of professional focus that would address all the anticipated needs of society. An area of professional focus signifies a pathway leading to a DVM degree. Colleges would choose to offer selected areas of professional focus most appropriate to their capabilities, according to a binational plan. Veterinary medicine is integral to the well-being of any future society. This is a pivotal moment for the veterinary profession and for veterinary medical education. Leadership, collaboration, and a shared vision will determine the destiny of the profession.

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## Foreword

In 2005, the Board of Directors of the Association of American Veterinary Medical Colleges (AAVMC), under the leadership of Dr. Lawrence E. Heider, Executive Director, and then president Dean Bennie I. Osburn, instigated a proposal to conduct a long-range planning study for academic veterinary medicine. A previous study undertaken between 1987 and 1991, known as "Future Directions for Veterinary Medicine," was conducted by the Pew National Veterinary Education Program and sponsored by the Pew Charitable Trusts.<sup>1</sup> In addition to leadership training and development of strategic planning principles and skills for faculty and college administrators, that study famously led to significant advances in veterinary medical education—notably, the greater application of tracking, or areas of emphasis within curricula, to allow students an opportunity to acquire greater knowledge and clinical skills in their chosen areas of endeavor, as well as the adaptation of technology and pedagogical processes to foster greater

problem-solving skills and self-learning capabilities among students. Greater emphasis on research was encouraged. In addition, several inter-institutional programs were established to offer better learning opportunities in certain fields. Several well-known programs, including a seven-school program for food-animal/production medicine led by the University of Illinois, the Gulf States Consortium for Aquatic Pathobiology, and the Center for Government and Corporate Veterinary Medical Practice at the Virginia–Maryland Regional College of Veterinary Medicine, continue today.

For its subsequent study, the AAVMC decided on a long-range planning project using a process called Foresight Analysis, a tool to look ahead over a 20- to 25-year time horizon. The objective was to determine a vision and future direction for academic veterinary medicine. The Norm Willis Group, a consulting team based in Ottawa, Ontario, was chosen to conduct the study. In addition to the team's

expertise with Foresight technology, they had previously worked specifically with issues in veterinary medicine. Their leader, Dr. Norm Willis, is the former chief veterinarian of Canada and he has served as president of the OIE.

The Norm Willis Group's final report, published in this supplemental issue of the *Journal of Veterinary Medical Education*, is intended to provide a basis for strategic planning, by individual institutions and/or institutional consortia as well as by the AAVMC at the national and international levels, for curricular development in academic veterinary medicine to meet challenges that may be faced by the profession in the future.

The Foresight analysis process involved teams of professionals who began by asking challenging questions about the future. The initial team of professionals was selected by the AAVMC executive, and this group was re-enlisted to complete the process at a final synthesis meeting. The initial challenge questions led to the definition of multiple plausible future scenarios, which were analyzed at two subsequent workshops. The scenarios were selected not on the basis of whether or not they were likely to occur but, rather, on the basis of high uncertainty of occurrence and of high impact on the profession should they occur by 2025 or beyond. During discussions of the scenarios, the workshop participants originated a majority of the ideas and concepts for the following report. Participants were nominated by representatives of AAVMC member institutions and by AAVMC officers. They represented a broad range of expertise within the veterinary profession. Using the scenarios as tools, the workshop teams were challenged to assume that a given scenario had occurred and to answer a series of questions pertaining to its impact on a variety of issues relevant to the profession and, most importantly, to academic veterinary medicine. They then looked backward to consider what might have happened in our world to

lead to that scenario. All ideas, concepts, suggestions, recommendations, and conclusions were carefully recorded during these discussions. The process was designed to unleash original thinking, to help the participants to escape from thinking about the future only as an extension of today's circumstances.

A final step, conducted by the synthesis team, involved distilling the ideas, concepts, suggestions, recommendations, and conclusions developed and recorded during the earlier workshop discussions of all scenarios to find mechanisms whereby academia might prepare tomorrow's veterinarians for any challenges the future may hold. The reader of this report is encouraged, therefore, not to look for solutions relevant to any specific problem in today's world, nor for solutions designed to meet any specific future scenario, but to understand that the objective of the study was to propose a responsive and flexible veterinary medical educational system that will prepare veterinarians for a myriad of opportunities and challenges in the next 20 to 25 years.

Funding for this project was provided by the AAVMC, Charles River Laboratories Foundation, and Merial Limited. The AAVMC expresses its appreciation to all the participants in this study.

#### REFERENCE

1 Pritchard WR. *Future Directions for Veterinary Medicine*. Durham, NC: PEW National Veterinary Medical Education Program, Institute for Policy Sciences and Public Affairs, Duke University, 1988.

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## 1. Executive Summary

### A PROFESSION IN TRANSITION

The environment of veterinary medicine is one of change. There are major demographic, political, environmental, disease, technological, and economic influences, all driving changes in society. These changes will have significant impacts on future veterinary medicine and veterinary medical education.

The current number of veterinarians in food-supply veterinary medicine, in biomedical research, in public health, in companion animal medicine, and in other anticipated needs is inadequate to address current and future societal needs and well-being.

How must academic veterinary medicine adapt in preparing veterinarians to respond to new needs of society? To remain relevant to shifting new societal needs,

veterinary medical education must prepare veterinarians for what might come in the future, not just for what can be seen now.

The single characteristic that distinguishes veterinarians, in every role they play, is their unique relationship with animals, operating at the interface between society and animals.

Veterinary medicine is the only profession in the health and medical field that is trained in comparative medicine.

Concern for animals, their health and well-being, and their interface with people, inserts veterinarians as critical components of public health and as essential health care providers to society locally, nationally, and internationally.

For veterinarians to be recognized and remunerated for their knowledge, compassion, integrity, and judgment, they must first demonstrate relevance to new societal trends.

The veterinary roles that benefit society most are those that demand and capitalize on the unique knowledge and abilities developed through veterinary medical education.

### **THE IMAGE OF VETERINARIANS**

The image of veterinarians in society is at the interface between animals and people.

The “Gentle Doctor” is a powerful and compelling image of veterinarians in the public psyche that should be expanded across all of the roles that veterinarians play in society.

The prime characteristics that veterinarians represent are:

1. compassion
2. expertise
3. humaneness
4. judgment
5. care
6. understanding

### **A VISION FOR ACADEMIC VETERINARY MEDICINE**

North American academic veterinary medicine is a global leader in the design and delivery of veterinary medical education systems.

It inspires and educates veterinarians to exemplary standards and values in an intellectually and emotionally rewarding career.

The profession is respected and valued by society for its leadership and dedication to the health and well-being of animals, people, and the environment.

### **A RESPONSIVE AND FLEXIBLE VETERINARY MEDICAL EDUCATIONAL SYSTEM**

Fundamental changes in the education of veterinarians are required in order to create a system or process that is responsive to future needs. Basic issues that must be addressed include the following:

- Without significantly increasing the length of the education, it is not possible for individual colleges to provide the requirements to meet all of the anticipated needs.
- The concept of change is for an adaptive and responsive system of veterinary medical education, achieved by defining the areas of professional focus, which would address all of the anticipated needs of society. An area of professional focus signifies a pathway leading to the DVM degree.
- Colleges will choose to offer selected areas of professional focus most appropriate to their capabilities. A national plan will ensure that all defined areas will be available on the continent in at least one college. Experts will also be centralized in appropriate centers of emphasis to create leading-edge critical masses of expertise.

- The Association of American Veterinary Medical Colleges (AAVMC) and the individual institutions must plan on a collective basis rather than an individual basis.
- Selection and admissions of students will be based on the premise that the profession ensures a predetermined minimal number of seats in each area of professional focus. For certain professional focus areas, the option will exist for a DVM degree to be earned by attending multiple colleges through an active, national, cooperative program. Such programs will require inter-institutional agreements with respect to residency, tuition and fees.
- Accreditation of colleges will be altered to allow focused educational delivery in some areas but no delivery in other areas.
- Licensing of a graduate veterinarian will recognize competency in a specific area or areas of professional focus.

### **PROCESS**

The objective of the study was to determine a future direction for academic veterinary medicine that would prepare veterinarians for the opportunities and possibilities that may emerge within the next 20 years.

The study analyzed multiple aspects of the veterinary profession, its relationship to components of society, and the veterinary medical educational process. The method used was Foresight technology, which seeks perspectives from the future rather than extending thinking from the present. It involved the expressed opinions of over 95 participants, together with those of eight members of the Norm Willis Group team.

Two distinct tools—challenge questions and scenario development—were used in the study. Eight challenge questions and eight scenarios were explored in four working meetings. The scenarios were:

- The Pandemic Disaster of 2015–2025
- The Great Animal Peace
- Brave New World of Modified Species
- Fragmented Profession
- One Medicine, One Health
- Global Warming, Eco-Crisis
- Norman Rockwell Veterinarian
- Globalized “Google Vets”

### **PRINCIPLES CONSIDERED MOST IMPORTANT**

1. Veterinary medicine must remain relevant to the changing needs of society.
2. Veterinary medical education can respond to these changing needs only by expanding the areas of education through creating areas of professional focus according to a national plan.
3. The number of graduating veterinarians must be increased, not only to address population growth, but

to allow the profession to respond to new demands and roles.

4. Academic veterinary medicine should reflect the existing and anticipated diversity in society.
5. Veterinary medicine should seek greater collaboration and cooperation with human health in the public health area, with veterinarians playing a more dominant role in the management of zoonotic disease, public health, and the impact on ecosystem health.
6. The public image and status of veterinarians can be enhanced only through a powerful and professional marketing and public relations campaign.

#### KEY RECOMMENDATIONS

1. The AAVMC must achieve consensus on two key points:
  - acceptance of the concept of an expanded veterinary medical educational program, leading to a DVM degree, through provision of areas of professional focus, perhaps identified as centers of emphasis, in North American colleges of veterinary medicine;
  - acceptance of the fact that veterinary licensure will not cover all areas of professional focus, but rather will lead to public assurance of competency in a selected area of veterinary medicine.
2. The AAVMC should develop a national strategic plan for implementation of the concept that each college will use as guidance to develop a specific strategic plan.
3. The AAVMC and the colleges should develop a plan to reduce student debt, at least in unfulfilled areas.
4. Colleges must develop opportunities for continuing education for veterinarians seeking to change careers and licensure in a new area of professional focus.
5. Colleges should capitalize on new technology to provide distance education.
6. The AAVMC should pursue, with the National Institutes of Health, the establishment of an Institute of Comparative Medicine.

7. The licensing boards through the American Association of Veterinary State Boards and the state or provincial veterinary associations should address the modification of licensing for graduate veterinarians to allow licensing for a "professional focus."
8. Accreditation of colleges of veterinary medicine should be limited to the requirements to teach the core program plus the areas of professional focus offered at that college.
9. The AAVMC, the American Veterinary Medical Association (AVMA), and the Canadian Veterinary Medical Association (CVMA) should come to consensus on major issues for the profession to ensure that there is a unified voice that speaks for the profession to prevent conflicting messages to the public.
10. The AAVMC could consider monitoring ongoing changes in society, in political systems, in the environment, and in disease, to assess any potential impacts on the future direction and education of the profession that may require the addition or alteration of areas of professional focus within the curriculum.

#### EPILOGUE

Veterinary medicine has a proud and admirable history with many achievements in which it can take pride. It is integral to and has much that it can offer to the well-being of a future society.

This is however, a pivotal point in time for the veterinary profession and for veterinary medical education. A decision to broaden the scope and potential of veterinary medical education is fundamental for the profession to navigate this transition.

Stimulated by the exploration of the eight plausible future scenarios, a system of veterinary medical education was elucidated. This system, as proposed, is believed to be responsive and flexible enough to allow the academic community to adjust to any future challenge.

Leadership, collaboration, and a shared vision will determine the destiny of the profession.

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## 2. Project Definition

On the first of February 2006, the Association of American Veterinary Medical Colleges and the Norm Willis Group signed a letter of agreement whereby the Norm Willis Group would complete an in-depth study of the future of academic veterinary medicine.

It was agreed that the study would employ a process of Foresight analysis, which would lead to the creation of a report suitable for developing a strategic vision for

veterinary medicine and veterinary medical education. The report would also be used by the AAVMC or its member institutions to create academic strategic plans.

An AAVMC Foresight Project Definition Meeting was held in Ottawa, Ontario, to discuss the specifics of the study in greater detail. The attendees in this meeting were the Executive Committee, the executive director and project manager of the AAVMC, and the members of the Norm Willis Group team.

During the meeting, expectations for the study were enunciated in a series of 21 questions, which have been organized into categories and are presented in Appendix A. Further clarification was detailed for the profile of participants to be invited to the subsequent meetings of the study. As well, tentative dates and locations for the meetings to follow were suggested.

To ensure ongoing validation of both the process and the deliverables, the Core Team defined specific actions that would provide them with assurance for their expectations of the study.

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### 3. A Profession in Transition

This section outlines the key pressures that are forcing a change in veterinary medical education if veterinarians are to remain relevant to and valued by society.

#### HISTORICAL BACKGROUND

Over the centuries animals have provided people with food, energy, wealth, companionship, and prestige. The relationship is a very intimate one, which is both passive and active. Animals have played a most significant role in exploration and in conquests of territory. However, the veterinary art did not become institutionalized until the eighteenth century, when the first veterinary schools opened in Lyons and Alfort, France, in 1761 and 1764.<sup>1</sup>

The first veterinary school in England was the London Veterinary College, founded in 1791. This was followed by the Edinburgh Veterinary College (Royal Dick), founded in 1823.<sup>1</sup>

A graduate of the Edinburgh school established the oldest existing, accredited veterinary college in the United States and Canada, the Ontario Veterinary College, in Toronto in 1862, later relocated to Guelph, Ontario (1922).<sup>1, 2</sup>

In the United States, the first veterinary colleges were established in 1852 and 1854, in Philadelphia and New York respectively.<sup>3</sup>

Today there are 28 veterinary colleges in the United States and five in Canada.<sup>a</sup>

Professional veterinary associations and administrative boards were formed to verify competency in standards of service and codes of ethics, so that unqualified persons would not be allowed to dupe an ill-informed public.<sup>1, 2</sup>

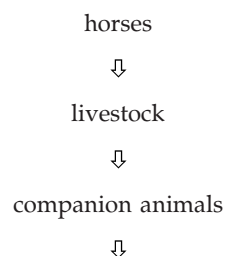
#### EVOLUTION OF THE PROFESSION

Until the First World War, horses were a mark of pride and a symbol distinguishing gentry from peasants. In North America, by 1800, the arrival of large numbers of settlers was accompanied by a rapid increase in the livestock population. By 1860, the number of cattle, hogs, and horses in the United States far exceeded that of Prussia, Great Britain, and Ireland combined.<sup>1</sup> Animals were essential to the settling of the continent and to the migration of people.

A major event for change in North America was the American Civil War, which created a need for persons qualified in the veterinary art, a demand for serviceable horses, and a high demand for beef and pork.<sup>1</sup>

After World War I, the influence of horses as a means of transportation declined and agricultural productivity expanded. As presaged by the sculpture "The Gentle Doctor" (Christian Peterson, 1937), the emphasis of the veterinary medical profession shifted once again by the 1950s toward companion animal medicine—an emphasis that remains today.<sup>b</sup> Recently, the globalization of food distribution and the market increase in livestock production have forced alternative approaches.

Therefore the emphasis of the veterinary medical profession has evolved from



a possible new point of transition in the future.

#### WHY VETERINARY MEDICINE MUST CHANGE IN THE FUTURE: THE BROADER ENVIRONMENT

In a word, the environment is one of change.

The global society, and what surrounds and influences it, are in profound change. These changes will have very significant impacts on future veterinary medicine and veterinary medical education. There are major demographic, political, environmental, disease, technological, and economic influences, all forcing changes onto society. A few examples illustrate the point.

- At 19:16 GMT, February 25, 2006, the global population passed 6.5 billion people (World Population Clock of the U.S. Census Bureau).
- Worldwide, the amount of forest is shrinking by the size of a soccer field every two seconds.

- The consumption of water is rising twice as fast as population growth.
- In the past 25 years, 38 new pathogens have emerged—75% originated as animal diseases (Mark Woolhouse, University of Edinburgh).
- With an annual increase of 76 million people, the world population is expected to reach 9.1 billion in 2050.
- With immigration into North America accelerating, combined with a declining birth rate, the ethnic diversity in society will continue to increase, with the associated impact on values.
- In 2007, for the first time in history, urban people will outnumber rural people.
- Political destabilization, inflamed by bio-terrorism and religious fanaticism, is expected to increase.
- Changes in the atmosphere are causing powerful shifts in the environment (melting of the ice caps, rising sea levels) and in the climate (hurricanes, flooding).
- Global water shortages, especially in heavily populated areas, will soon approach critical levels.
- The emergence of new diseases is occurring about every eight months and the threat of new zoonotic diseases is very real. Of the more than 1,400 pathogens causing human disease, 800 have crossed the species barrier from animals.
- The speed of global travel and of disease transmission are surpassing control measures. The rate of habitat change leads to unprecedented disease exposures.
- Information technology has flattened the globe for access to information and service.<sup>4</sup>
- Consumer spending power in emerging economies will go from \$4 trillion to \$9 trillion by 2015, but the gap between rich and poor is increasing.

How will these changes alter the needs of society? How must academic veterinary medicine adapt to prepare veterinarians to respond to these new needs?

#### **OTHER INDICATIONS OF THE NEED FOR CHANGE**

It is unlikely that the current philosophy on how to protect animal health will be adequate in the future. There are vulnerabilities in the animal health framework. To safeguard the US economy, public health, and food supply, there must be recruitment and preparation of additional veterinarians into careers in public health, food systems, biomedical research, diagnostic laboratory investigation, pathology, epidemiology, ecosystem health, and food animal practice.<sup>5</sup>

The convergence of animal health and public health in the area of zoonotic and newly emerging diseases is a critical link to societal well-being.<sup>6</sup>

There is a need for more veterinarians to participate in or support biomedical research. To date, veterinary medical schools have shown a lack of commitment to prepare and train veterinary students for veterinary careers other than private clinical practice.<sup>7</sup>

The perspective on the role of animals in human society and in the ecosystem has changed. Research in veterinary science transcends species boundaries and is critical to the protection of public health. Such research is crucial to the advancement of our understanding of and our response to impending risks.<sup>8</sup>

This need for change is similarly recognized in other professions. For example, the engineering profession seeks to enrich and broaden engineering education so that those technically grounded graduates will be better prepared to work in a constantly changing global economy.<sup>9</sup>

#### **IN SUMMARY**

The need is eminently clear. The global societal environment is shifting. To remain relevant to the new needs of society, veterinary medical education must prepare new veterinarians for what might come in the future, not for what can be seen now.

## **4. The Process and Methods**

The method employed in this study was Foresight—a systematic approach for anticipating the future. Foresight encourages participants to imagine possible futures over a 10- to 25-year future horizon without it being an extension of present thinking. It provides a means of liberating thinking and conceptualizing consequences and leading triggers.

Foresight allows preparation for diverse future challenges with adequate lead time. It does not predict or forecast the future, nor is it a strategic plan. Rather it anticipates and creates multiple, plausible futures that are possible and believable. These futures may be positive or negative, but in their diversity they bring into view issues and perspectives that may not have been initially considered.

This study utilized two distinct tools, namely Challenge Questions and Scenario Development, to stimulate the thinking of invited participants (Appendix F) from a wide range of endeavors, as selected by the AAVMC. This thinking was elucidated in four separate working meetings.

In a Scoping Meeting, held in Atlanta, Georgia, sixteen participants began the process of framing the study. They defined the lenses or critical perspectives, the key drivers causing change, trends, and discontinuities that would be used as parameters to develop the Challenge Questions and the Scenarios. As well, they started the process to develop scenarios.

On the basis of these inputs, the Norm Willis Group Team developed eight sets of Challenge Questions and eight Scenarios to be explored in two workshops. The two workshops, held in Fort Collins, Colorado, and Knoxville, Tennessee, each answered four sets of Challenge Questions and explored four Scenarios. The Challenge Questions and the Scenarios were all considered from the perspective of the year 2025.

#### **FORT COLLINS WORKSHOP CHALLENGE QUESTIONS**

1. Societal Expectations
2. Education Format and Delivery
3. Business Models
4. Ethics and Values

#### **FORT COLLINS WORKSHOP SCENARIOS (SEE APPENDIX C)**

##### **1. Doomsday: The Pandemic Disaster of 2015–2025**

There is a major resurgence of zoonotic pandemics. Despite modern medicine, the impact of the new zoonotic diseases is reminiscent of the plague pandemics that devastated Europe centuries ago. Pets and animals are seen as the principal pool of disease and major transmission vectors and are destroyed indiscriminately.

The economy is in deep recession as governments at all levels place restrictions on travel, and actions are in crisis mode. Veterinarians are suspected of being too lenient and part of the problem. The quality of veterinary care drops and enrollment in veterinary schools also drops drastically.

##### **2. The Great Animal Peace: Eradication of Zoonotic Health Threats**

The risk of zoonotically based pandemics, such as avian influenza and BSE-related diseases, has virtually disappeared, similar to the war-free era of the Pax Romana. Modern veterinary epidemiology, vaccinations, risk-monitoring technologies, and risk-management procedures for diseases are prevalent and applied rigorously. Science and technology ensure that all animals are carefully monitored and any early onset of disease results in quick elimination. Animals, both large and small, are seen as valuable contributors to society's needs.

Veterinarians are seen to be largely responsible for this change, through visible public efforts, active promotion of citizen education, and major influence in public health programs.

##### **3. Brave New World of Modified Species**

Systematic mapping of the genome of animal species leads to massive genetic testing, modification and cloning of animals. Examples include: more disease-resistant strains for the food supply, novelty pets with designer features, and synthetic animal-cell-based protein foods. Additionally, individually genetically tailored designer therapeutics and drugs are created.

These developments raise major ethical challenges, such as organ farming and food safety. They also give rise to new threats, such as new diseases rising from xeno-transplantations.

##### **4. Fragmented Profession**

The veterinary profession evolves and eventually fragments into very different streams. Each stream requires different education levels, certification procedures, and business models. Different teaching institutions are created for the various streams.

The ethical guidelines and requirements are very different, creating an unprecedented divide.

#### **KNOXVILLE WORKSHOP CHALLENGE QUESTIONS**

1. Science and Technology
2. Status of Veterinarians
3. Relationship with Public Health
4. Policy, Regulation, and Funding

#### **KNOXVILLE WORKSHOP SCENARIOS (SEE APPENDIX C)**

##### **5. One Medicine, One Health**

Health care professionals acquire unified basic training, and public health services are subject to similar standards for humans and animals. Recurring threats of zoonotic diseases have created a move to standardize the basic training and preparedness of all health professionals. Public health agencies are staffed with specialists in human health as well as animal health. Veterinarians enjoy the same status and remuneration as physicians, and are subject to similar expectations and ethical standards. Science and technology are continually adapting these practices, as humans demand the best for themselves, their animals, and their food.

##### **6. Global Warming, Eco-Crisis**

Drastic changes in traditional weather patterns lead to changes in food production and dislocation of established food-producing regions. Personal health and security concerns are dominating public agendas, and regional conflicts over resources are creating major international tension. Isolationism and globalization are in continual tension as governments seek to control the negative spiraling of public confidence. There is a major stress on freshwater supplies that leads to a fundamental re-evaluating of the role of pets and the sustainability of food-producing animals. Increasing spread of new tropical diseases in previously temperate zones alarms public health authorities into a crisis mode. Veterinarians become more proactive, and take on a new role as eco-health stewards.

##### **7. Norman Rockwell Veterinarian**

The veterinarian, as captured by painter Norman Rockwell, offers a local, traditional, cottage-industry model of service. The emphasis is on personal service, and the focus is on small animals. Veterinary clinics are seen as part of the local business environment with strong community links. Technology is present, but is seen as low-key and non-invasive, primarily serving as an aid in the efficient delivery of very individual and customized service. Veterinarians stand apart from more technologically dependent professions on principle, providing personal care and service.

## 8. Globalized “Google Vets”

There have been major advances in technology, leading to widespread use of computer-linked sensors to carry out diagnostics, administer therapies, or carry out robotic tele-surgery from great distances. Clients, through a “Google vet service,” have instant access to global remote diagnostics and tele-therapies from their home or farm computers. Traditional, locally based veterinary clinics are dramatically transformed to global offshore service providers. Veterinary education is now universally accessible and largely delivered through highly sophisticated distance learning technologies, with completely realistic, textured, 3-D holographic animal models. The dominant forces shaping the business and education models for veterinarians are global and virtual, with a large number of specialists offering tele-veterinarian services from offshore locations like India. There is intense global competition for franchises and services.

The full range of the Challenge Questions can be found in Appendix B, and narratives of the Scenarios are presented in Appendix C.

The Challenge Questions and Scenarios were addressed in the context of societal expectations and implications for the skills, competencies, and education of veterinarians. Finally, the participants undertook “backcasting” to determine the critical actions, decisions, and events that could have resulted in these scenarios.

Workshop 1 had 35 participants and Workshop 2 had 44 participants (see Appendix F).

In the final Synthesis Meeting, held in Sacramento, California, a group of 16 participants, 11 of whom had also attended the Scoping Meeting, analyzed the outputs of the two workshops. Under six themes, which reflected the grouping of the original 21 questions, they selected and summarized key actions, which were deemed most important for the veterinary colleges and the AAVMC to consider.

In developing the Final Report, the Norm Willis Group Team has taken into consideration the outputs, comments, and opinions of all four meetings.

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# 5. What We Heard: What May Lie Ahead for the Veterinary Medical Profession

In this section we present a summary of what was said during the courses of discussion around the Challenge Questions and the Scenarios, and during independent, individual interviews.

## 5.1 EDUCATION

### Philosophy

It is essential that the veterinary profession respond to the future needs of society to remain relevant. In its present form, academic veterinary medicine cannot respond to all of the currently apparent societal needs, let alone the unknown but anticipated needs of the future. Clinical veterinary medicine is the predominant thrust of present day veterinary medical education and is the basis of the positive public image that veterinarians presently enjoy. Therefore, it is desirable that any modification of the philosophy of veterinary medical education build on, not detract from, this well-established and much valued reputation and contribution.

However to respond to both foreseeable and, as yet, undetermined future needs, a broad range of skills, knowledge, and attributes will be required, e.g., communication skills, leadership abilities, cultural competence, business skills, interpersonal skills, values, and ethics. It was suggested that the number of available, competent, licensed veterinarians be increased to address these needs, rather than be pulled from or compete with existing professional demands.

At present it is difficult for all colleges to deliver all the desired skills. Therefore colleges should consider developing areas of professional focus, perhaps identified as centers of emphasis.

Although there is a risk of perceiving colleges as first rate and second rate, the intent is to create institutions of focused expertise in selected areas for veterinary medical education, operating in communities of knowledge and competencies. These would create critical masses of expertise and efficiencies of financial, human, and physical resources. The range of training could be reflected in a national plan developed by the AAVMC, which would ensure that all options of veterinary endeavor in the future would be available for training at some colleges within the context of an integrated educational framework.

All colleges could collaborate on the total delivery of the national veterinary medical educational program, and students could choose to qualify for their DVM degree by attending multiple institutions.

On the basis of current demographic trends in society, there is a challenge for the colleges, faculty, and programs to reflect the diversity of ethnicity, culture, and total societal needs.

It is a reasonable expectation that students will be able to anticipate the length of education required to achieve their degree in the focused area of their choice, and that this will



be commensurate with the projected remuneration after graduation.

Although students are encouraged to choose their desired career path and lifestyle, the profession as a whole has a responsibility to address the needs of society.

### **Structure**

On the basis of a national plan, as developed by the AAVMC, colleges should choose to focus on certain areas of competency development that reflect their expertise and are most cost-effective for them. National standards could be developed to permit college accreditation, taking into account these areas of professional focus.

Following a specifically defined prerequisite program, which could be very important to achieve diversity and to obtain students already possessing the desired skills, there could be a two- or three-year core program, standardized across the continent. This would be followed by a one- or two-year program in an area of professional focus, which would lead to a DVM (professional focus) degree. If desired, a postgraduate program could follow, leading to additional advanced degrees e.g., PhD. The professional focused training could be provided in institutions that are different from those providing the core training.

Dual degrees could be obtained simultaneously under intensified full-year programs, such as DVM/MPH, DVM/PhD, DVM/MBA, DVM/biomedical engineering, or DVM/information and data analysis.

Licensure would be based on ensuring competency in the area or areas of professional focus.

To change a career path any time throughout a career would require retraining in the selected program area with a recognition of competency in that new professional focus.

Teaching hospitals may not be required in all colleges or all areas of professional focus, but would be essential for specific clinical areas of focus. Although some clinical experience could be obtained in private practice, the emphasis on education and the degree of advanced competency and experience in these teaching hospitals may be required for accreditation.

Modular training, which would be open source, portable, and non-linear, could expand access.

Research, including clinical research, should be an essential part of the functioning of each area of professional focus to advance knowledge and to be on the leading edge of that particular area.

### **Educational Delivery**

Online, Web-based training could become an integral element of the educational process. However, hands-on experience is essential and fundamental to achieving a DVM degree. Virtual training could also be very important in providing lifelong education to maintain competence and to supplement a professional choice to change a career path. As well, distance education, both nationally and internationally, would allow best use of the unique competencies in the specific areas of professional focus.

Training could occur through cooperation amongst multiple institutions. Additionally, collaboration with other health

professions, and with other disciplines and departments on campus, could expand options for educational delivery.

Consideration could be given to providing parallel training to paraprofessionals to permit better integration into health teams and corporate or community practices.

### **Curriculum**

The pre-veterinary or DVM curriculum could consist of a nationally standardized core program of material, which would also include aspects fundamental to the profession as a whole, such as communications, leadership, public relations, values, ethics, problem-solving, dilemma management, conflict resolution, and the management of change. It would also be desirable to place emphasis on knowledge transfer and skills development.

In the segmented training program, as developed across the national plan, the curriculum could be broadened to provide options for such focused areas as:

1. Public health
2. Ecosystem health
3. Emergency management and crisis response
4. Business—corporate model of practice
5. Food safety and security
6. Clinical medicine
  - Small animals
  - Large animals
  - Equine
  - Further subdivisions of clinical practice

The curriculum should be portable.

However, licensure for selected areas of professional focus and accreditation of colleges (taking areas of professional focus into account), are essential to permit such tailored curricula for the streams of emphasis.

### **Recruitment and Admissions**

To effect a change, it would be necessary to make the full scope of veterinary medicine visible to society, especially to the applicant pool.

It would be beneficial to have a national recruitment strategy that seeks to achieve a greater diversity in applicants, approaching the diversity of society. Diversity can be accommodated in all its meanings (ethnicity, cultural, values, needs). The recruitment strategy could also stress diversity of interests, e.g., experience in public practice, leadership, community development, communications, business, and demographics. As well, recruitment could be started in secondary schools.

Health and other professions could also be mined to recruit students to particular areas of focus.

## **5.2 STATUS OF VETERINARIANS**

### **Role in Society**

Veterinary medicine, as the only health profession with extensive training in comparative medicine, provides an essential role in public health, which should be emphasized.

It requires refocusing the role of veterinarians in society to that of serving human health as well as animal health. This approach also involves broadening and increasing the roles for veterinarians in society by bridging the gaps among animals, humans, and the environment.

Considering veterinary medicine as a public health profession leads to a responsibility for ensuring a safe supply of food and water, as well as the associated responsibility for the protection and preservation of a sustainable ecosystem. Further, a vision could be fostered of “shared” responsibility for public safety on issues such as food safety, zoonotic diseases, xeno-transplantation, and microbiology.

An important approach is for veterinarians to assume a lead role in being credible, objective, and respected spokespersons on animal issues.

Throughout this course of change, it is important that the core values of the profession not be abandoned. The image of veterinarians as broad comparative practitioners is valuable to retain. However, if the profession fails to effect a change in the broader roles it plays in society, there is a serious threat that it could become a trade.

### **Leadership**

Of critical importance to the status of veterinarians is their expression of leadership.

Veterinarians can serve as team leaders in many issues involving the animal/human interface. This would include assuming leadership as spokespersons on animal issues.

Examples of roles in which veterinarians could rightfully assume leadership include leadership of biomedical teams, leadership in the management of related crises, and leadership in the interdependence of eco-awareness, the food system, and animal/human health.

Veterinarians could be positioned to demonstrate leadership in contributing to public policy development and implementation in relevant areas, since greater leadership will lead to greater influence on public policy.

Additionally, veterinarians could exert leadership in the pivotal role of managing the inevitable changes that will flow out of the evolution of society’s relationship with the animal population.

### **New Skills**

In general, it will be necessary to take a multi-faceted global view of issues in the areas of science, economics, politics, and societal trends. Special emphasis should be placed on gaining new knowledge of contemporary public health issues. This could be addressed in specific areas of professional focus for comparative medicine, using examples such as the global monitoring program of the Centers for Disease Control and Prevention (CDC).

New skills to be addressed in the non-science areas include:

- Leadership
- Ethics
- Business management
- Law
- Crisis management

- Cultural competencies
- The ability to filter and transmit information in written form and verbally with people in person

Areas to include for new science skills include ecosystems, comparative medicine, bio-informatics, genomics, proteomics, and the ability to coordinate expertise for end users at the interface between science and policy.

Admissions could consider requiring the development of some of these skills as prerequisites during the pre-veterinary training, or selecting students for admission who already have acquired and demonstrated some of these skills.

### **Role in Policy Making**

Veterinarians need to be at the table for effective design of policy, regulation, and technology. Veterinary medicine needs to have a political voice, a plan, and a target to capitalize on opportunities to respond. Greater leadership will lead to greater influence on public policy.

Consequently, AAVMC could consider developing an enhanced policy role that would create a congressional and broader political awareness, and would prepare and promote veterinarians for senior political government positions. As well AAVMC, in parallel with other veterinary organizations, could advocate for the profession, particularly in education and preparation for specific policy roles.

An approach could be to encourage more joint DVM and legal degrees to enhance promotion of veterinarians and lobbying for policy development.

Veterinarians could be more prominent in public policy that concerns health care and disease prevention. To do so, they need to have more influence on the consideration of legislation in areas involving public health and the impact on the determinants of health. A possible role is for veterinary medicine to be at the interface between science and policy, assisting policy makers to “remain current” with scientific and technical advances.

Veterinarians may also have a public policy role in areas such as eco-health, as well as having a voice in the first line of defense against natural, accidental, or deliberate threats.

### **Public Perception of Veterinarians and Veterinary Medicine**

There is a strong need to focus on and promote the value that veterinary medicine creates for society and animals, as well as the value of animals in society. Public trust will not be based solely on science, but will be strongly influenced by the credibility and balance that veterinarians can offer. It is important then to encourage the ability to communicate with people in person, and to interpret and place information in context to help their understanding.

AAVMC has a role to be the national voice for veterinary medicine as a human health profession, and to stress the importance of the human–animal relationship. If veterinary medicine is to be connected to human and public health, it is critical to be able to explain the relevance of veterinary medicine to human health. In balance, the profession must keep its core values but broaden the public perception and the profession’s responses to change.

To improve their status, veterinarians must be more visible. The status will increase by connecting to and focusing on human health and public health issues. The development of a professional focus in public health will also lead to a greater profile. The profession needs a national strategy to educate the public, and especially its youth, about the broader role of veterinarians in society.

To be recognized and to have influence, it is critical that the profession speaks with one voice, to achieve unity and not fragment its impact. Veterinarians can present as leaders and expert spokespersons on areas of animal concerns, and as the first point of contact for issues pertaining to animal health and well-being.

Veterinarians may consider stepping beyond their traditional roles and into such areas as environment, social health, global health, and as “guardians” of the safety of new biomedical technology.

Veterinarians need to increase their role in community services, and to maintain and project an image of professionalism, caring, and giving. As well, it is important to the image of both the profession and individual veterinarians to mentor young people and future veterinarians.

### 5.3 ACCREDITATION AND LICENSURE

#### Accreditation of Colleges

To accommodate the change and refocusing of curricula to allow students to select an area of professional focus, the accreditation must be flexible enough to recognize that all institutions may not offer the degree in all potential areas of professional focus.

Because a few areas of professional focus may require portions of the curriculum to be offered at more than one institution, accreditation standards will have to consider the pathway rather than a single institution.

The accreditations could recognize the convergence of human, animal, and ecological health, with AAVMC facilitating the development of standards for this convergence. As well, AAVMC could consider the development of quality control standards to allow this accreditation of the colleges. These standards could be continental in scope, and in the future may serve as models for implementation globally.

#### Licensure

Globalization and technology diffusion require standardization of competencies. For academic veterinary medicine and the colleges to respond to the broader needs of society, it is essential that they focus in selected professional areas. In doing so, the curricula will have to be tailored to emphasize the specific chosen areas. This will require changing the requirements for licensure to ensure competency in selected areas of professional focus as DVM (specified professional focus).

The verification of competence could be based on outcomes, and the standards used would be subject to rigorous peer review.

### 5.4 ALLIANCES AND PARTNERSHIPS

An aggressive pursuit of strategic partners will be absolutely essential for the future success of the AAVMC and the colleges.

Partnerships could be established

1. at an educational level,
  - by forming collaborations with other disciplines and colleges on campus to form interdisciplinary links to business, law, education, science, medicine, and social sciences,
  - by collaborating amongst the veterinary medical colleges on a national plan for veterinary medical education,
  - by making greater use of adjunct faculty and inter-institutional appointments,
2. at a government level,
  - by collaborating with the United States Department of Agriculture, the Department of Homeland Security, and departments of public health, environment, and natural resources, for research, funding, crisis management, and the security of the food supply,
3. at an internal professional level,
  - by AAVMC collaboration with the American Veterinary Medical Association (AVMA), Canadian Veterinary Medical Association (CVMA), and state and provincial associations of animal health and veterinary medicine to achieve unity by speaking with one voice for veterinary medicine, and for consensus on a national agenda for veterinary medical education, perhaps by forming an “Association of Associations,”
4. at a public health level,
  - by promoting veterinary medicine as a human health profession, through collaboration with the CDC, the Association of Schools of Public Health, and with the Association of American Medical Colleges,
  - by promoting, with the National Institutes of Health (NIH), the creation of an Institute of Comparative Medicine, and by bridging the concept of “One Medicine,”
5. at a corporate or private sector level,
  - by working with the food industry, the pharmaceutical industry, the Animal Health Institute, the agricultural production industry, and the human health insurance industry,
  - by collaborating in the development of the skills and competencies required to meet their needs, to emphasize the breadth of scope of veterinary medicine, and to seek support and funding,
6. at a technical level,
  - by partnering in research to access and capitalize on the latest scientific developments, and to verify their safety and legitimacy,

- by cooperating in the development of technologists to complement the development of corporate or community practice teams, to achieve the most effective delivery of mission in the future,
7. at a community level,
- by collaborating with other public health contributors in addressing the daily health level of society versus episodic health care events, stressing the role that animals play in the health of society and the opportunity to mitigate impacts at the source,
8. at a global level,
- by partnering with organizations such as the World Organization for Animal Health (OIE), the Food and Agriculture Organization of the United Nations (FAO), and the World Health Organization of the United Nations (WHO),
  - by preparing future veterinarians for deployment to address zoonotic disease prevention and control, for crisis management at the local, national, and international level, and for the eradication of animal diseases at source,
  - by engaging internationally on the accreditation standards of education and ethics,
  - by demonstrating leadership in veterinary medical education,
  - by being the primary representative of comparative medicine.

In addition to these suggested collaborations, the AAVMC and the colleges could reach out in a concerted fashion to such non-traditional areas as eco-health, social sciences, law, engineering, and change management.

### One Medicine

The AVMA, CVMA, AAVMC, and the colleges could promote public acceptance of the role of veterinarians in improving and protecting the health of people, of animals, and of the environment. This will require first creating an awareness, then an integration into public health and human health, and then finally acceptance.

Through closer collaborations with public health and human health, particularly in communications and training, common integrated roles can be developed for the benefit, security, and prosperity of society. This would be guided by a concept of "One Medicine," which the AAVMC could drive, through the development of a national plan.

### 5.5 TECHNOLOGY

The absolute key for the future veterinary medical profession is adaptiveness and responsiveness. Technological advances in the future will be rapid and will exceed all expectations. Therefore, the need for the profession is to expect change and be ready to adapt and accommodate changing needs and opening opportunities. Academic veterinary medicine must prepare veterinarians for these events.

#### For Education

Academic veterinary medicine should take full advantage of new technology. As an integral part of the education process, technology can help colleges increase the number

of students and generate revenue. Distance education from experts at centers of emphasis can occur both nationally and internationally. AAVMC may consider establishing a goal to have a virtual or global classroom in every college.

Virtual technology can be used to complement hands-on experience, and to customize educational programs for multiple purposes. Simulation can be used to supplement surgical and diagnostic programs. To take advantage of such technological opportunities, AAVMC could promote the use of a net-centric, open source, portable system of delivery for education.

#### For Use by the Profession

Tele-medicine will permit the availability of focused expertise at the colleges to smaller or remote practices, to smaller urban clinics, and to international sources of need.

Large corporate practices will be able to offer advanced technology for diagnostics and therapeutics, while hand-held devices for diagnostics or instant information access will be important for rapidly addressing potential problems, for finding solutions, or for monitoring ecosystem health.

Tele-diagnostics and new diagnostic methods will also have an impact on surveillance and modeling.

Colleges must strengthen their abilities to evaluate, test, and deploy new diagnostic innovations. They must also enhance trend detection and analysis as well as disease control strategies. In addition, there is a role in scanning and interpreting new science and technology development, and in evaluating new skills and tools such as genomics and bio-information. This could be considered for an area of professional focus in colleges. At the very least, the standards for college accreditation should reflect these new technologies.

Another new opportunity for veterinary involvement could be in areas such as bio-farming, genetically modified animals, and agri-ceuticals. These new technologies will bring with them ethical questions in society for which veterinarians could play a critical interpretive role in framing the debate.

### 5.6 FUNDING, COSTS, AND REVENUE

#### Lobbying

Lobbying is an important thrust to enhance the economic position of the profession and to recognize the critical contribution that animal health makes to societal productivity and economic competitiveness. AAVMC and the colleges can seek increased public and private funding by emphasizing the comparative medical aspects of the profession, the social and economic elements, as well as the community and public health benefits.

These efforts could be strengthened by having the AAVMC become more actively involved in economic policy, and by engaging more lobbyists. Also, the promotion of public funding for public good outcomes creates a new economic model.

#### Educational Funding

The availability of funding will directly affect the ability of the profession to address the shortage of veterinarians, and to meet new functional and specific area demands. AAVMC could develop a model for enhancing public and private

funding, using a different language to engage different opportunities. Funding will be attracted through increased consumer and public confidence in the value of veterinarians.

AAVMC and the colleges could seek to develop alternative sources of funding through potential new revenue streams, such as opportunities to sell knowledge products and to exploit distance education. Agriculture will not necessarily be the driver. Another opportunity may be to seek directed funding for specific areas such as food animal veterinarians, and preparation for crisis management.

#### **Tuition Fees**

A changed public attitude toward veterinarians can lead to greater recruitment and financial support. The economic burden of a student's debt impedes progress by the profession. This is compounded by the low level of remuneration for graduate veterinarians. This remuneration is also influenced by the amount of disposable income in society, and by the status of animals in society. Hence a new model for tuition fees is required to increase access by students.

Another area of expanded government and corporate support is student placement and mentorship related to the public perception of risk in the ecological and food-security systems.

To increase student numbers, the issue of student debt should be addressed in an articulated plan.

#### **Research Funding**

AAVMC has two key roles in research funding:

- to identify new sources of research funding
- to maximize the development of infrastructure to support collaborative research.

A prime strategy for the AAVMC is to seek NIH funding for research and development, by stressing the role of veterinary medicine in public health, and by advocating the creation of a NIH Institute of Comparative Medicine.

Possible sources of funding are

- industry (e.g., pharmaceutical companies, device manufacturing, private insurance sector)
- state and federal governments (e.g., the National Institute of Health, the US Department of Homeland Security, the US Department of Agriculture)
- contributions to the public good such as bio-terrorism or agro-terrorism, which may become areas of focus for some colleges
- transdisciplinary, collaborative research approaches
- new areas of research in tele-medicine, remote medicine and surgery, sensing, surveillance, epidemiology.

## **5.7 SOCIETY**

### **Role of Veterinarians**

What is emerging is a view of the role of veterinarians at the interface of animals, humans, and the environment, with a goal to protect and improve animal, human, and environmental health. The profession needs broader community engagement to determine the societal needs, and then to

bridge the gap between its current roles and these societal needs. There is a need to emphasize that the veterinary medical role is for humans as well as for animals.

Veterinarians must step beyond their traditional roles and into social health and the environment so that the phrase "healthy animals—healthy food—healthy people" can take on a new meaning for the profession.

The human–animal bond is more important to an aging North American population. Veterinarians have a role as objective, caring, and ethical spokespersons on animal issues. Although this will mean working with humane societies and other cultures, the relationship of veterinarians as protectors of animal well-being is important.

In the medical field, veterinarians have a unique knowledge of the impacts of zoonotic disease, and they should lead in this area.

If terrorism and global conflict become more important to global society, there will be a need for veterinary skills, and veterinarians should prepare for and participate in crisis management.

Another role for veterinarians is ethical leadership in preparing for rapid environmental shifts.

Additionally veterinarians have an opportunity to capture a more visible role as leaders, change managers, educators of the public as well as students, and as respected and credible communicators.

### **Diversity Requirements**

The North American society will become more diverse, and that change will be reflected in an increased need for diversity in the profession, embracing racial, ethnic, cultural, and discipline diversity. Society's attitudes to pets and animals will also become more diverse, and the profession must be prepared to address this issue. As well there is a need to protect biological diversity by preserving genetics and species in the face of disease occurrence. Therefore, it is important that cultural competencies are embedded throughout the veterinary curriculum.

### **Marketing and Public Relations**

There is a critical need to explain the relevance of veterinary medicine to human health. The image must focus on the value that the profession creates for society, and the value of animals in society.

As well, there is a need to promote the role of veterinarians in the production of safe animal protein food in a way that preserves the health of the environment and also animal welfare.

There is a need for the profession to dialogue with society on its perceptions of veterinary medicine. The profession must be prepared to respond but at the same time preserve its core values and its scientific integrity.

To move forward will require a national strategy to educate youth and the public about the broader role of veterinarians in society. This can be supported by promoting and making available the achievements and successes of the profession's past history, while projecting its role for the future.

## 5.8 BUSINESS MODELS

### Public Model

There may be a growth into convergent team practices, which are linked to human health. If this is so, these practices are likely to be corporately managed as “health management organizations.” In most communities, veterinarians could develop into “health care practitioners” who provide a public health and medical advisory role as well to the community. This growth into public health roles could lead to having this function built into a public service cost.

### Urban Models

There is a trend in urban companion animal practice toward corporate practices with the possibility of developing the franchise model. This could be extended into global corporate organizations in which there would be some local control but with much better brand recognition.

However, remote technology and relationships with networks of specialty practices could also support a parallel growth of local community-oriented clinics.

There is a definite trend of orientation toward wellness practice, supported by insurance programs and technology advances such as bio-sensors.

### Rural Models

The trend is toward corporate practices made up of multiple veterinarians, supported by teams of paraprofessionals and alternative technical advisors, to address food animal production. The elements of emphasis are toward bio-security, traceability, and on-farm food safety standards. As well, more veterinarians may be incorporated into vertically integrated production models.

Complementary to this movement could be a growth of niche practices that address the needs of large companion animals, exotic or non-traditional species, and organic or hobby farm operations. Distance technological linkages to networks of specialty expertise may also support these practices.

### Corporate Model

In addition to corporate practices and food animal production, some corporations may develop on the basis of leading-edge genomics technology. Although capital intensive, these could develop into expert corporations providing such products as designer animals, pharmaceuticals, therapeutics, and xeno-transplantation.

### General

The trend is expected to be toward larger practices with at least three veterinarians in order to realize the desired lifestyles.

All models point toward a more business-based orientation with a trend toward the outsourcing of practice management, and other competencies such as nutrition, husbandry, and engineering.

As well there may well be an increased use of paraprofessionals and supplementary support staff in all forms of practice.

There could be a shift to blending aspects of human health and wellness care into all practices of veterinary medicine.

## 5.9 VALUES AND ETHICS

### Values

In considering the social responsibilities of the veterinary profession, it is necessary to determine the expectations of society for the profession. The Veterinarian’s Oath acknowledges society as the primary client of the profession, but this leads to dilemmas of societal expectations.

- Is the primary obligation to the social benefits of using animals, or is it to the animals themselves?
- Is the primary obligation to animal welfare, or is it to economic benefits, or to public health?
- Is the primary client the human or the animal?
- Is the veterinarian working for the patient or the client?
- Is the veterinarian responsible for the patient and the advocate for the animal?

The new understandings of the links between animal and human health emphasize the public health responsibility, but there is a growing expectation that the primary client is the animal and its welfare.

- Between small animal and large animal practices, the moral status of animals changes.
- Is the human–animal relationship one of guardianship or property?

This expectation creates a dynamic tension within the profession. But the issue is less about tension within the profession and more about the relevance of the profession to society. How the profession shapes society’s expression of values and ethics in the future will define how the profession is seen in society.

Veterinarians must actively engage in these ethical debates, which are central to the paradox of the profession. The profession cannot rely on assumed values and ethics. However, strategically the profession is managing a dilemma—it is not solving a problem. The debate is at the interface of animal usage and humans.

The integrity and professionalism of veterinarians are universally recognized. However, as cultural diversity within the profession increases to match that of society, it will bring varied understandings of what personal integrity, trust, and other values mean. It is necessary that the profession negotiate, reinterpret, and reach consensus on what these fundamental and core values will be for the profession.

### Ethics

The “social contract” professionals make with society is that they are given the benefits of professional autonomy in exchange for a commitment to high standards of conduct, which the profession itself enforces on its own members. The profession should reconsider its system of self-governance of ethics, or legal decisions will dominate.

Ethical responsibilities of the profession to society include:

- participation in the public debate over the development and regulation of new technologies,

- education and communication to the public about disease threats and crises (who speaks authoritatively for the profession?)

It is necessary to teach the ethical implications of new technologies and to have proactive engagement in discussions of the ethics of technological development.

If the profession proceeds to a state of segmentation and areas of professional focus, there is a potential for conflicts of position to arise. It will require an overarching umbrella group to speak for the entire profession.

Since veterinary medicine is a global profession, it may well require international engagement and agreement on standards and ethics.

## 6. Discussion: Elaborated Principles and Key Recommendations

### 6.1 VETERINARIANS, VETERINARY MEDICINE, AND ACADEMIC VETERINARY MEDICINE

#### What Makes Veterinarians Unique

The single characteristic that distinguishes veterinarians is their unique relationship with animals. This relationship exists at the interface between society and animals.

Veterinary medicine is the only profession in the health and medical field with training in comparative medicine of multiple species. Veterinarians use a comparative matrix as a way of solving problems. Concern for animals, their health and well-being, and their interface with people, inserts veterinarians as critical components of public health. They are essential health care providers to society locally, nationally, and internationally.

#### What Are the Roles that Veterinarians Should Play in Society?

Veterinary roles that benefit society most are those that demand and capitalize on the unique knowledge and abilities developed through veterinary medical education. In addition to practicing clinical veterinary medicine, by defining roles in areas such as public health, eco-health, food supply and safety industry, crisis management, research, and business management, veterinarians and the veterinary medical profession will fulfill their obligation to the well-being of society and animals.

Veterinarians are ideally suited to serve as translators of new science, and as interpreters of disease prevention and consequences on animal and human populations.

The comparative matrix education of veterinarians is particularly suited to complex decision making. Veterinarians can handle multiple parameters in situations such as disaster and pandemic disease management. As an extension, veterinarians are particularly effective as coordinators in multi-stakeholder events, both locally and nationally.

The values and ethical standards that are fundamental to the profession must become clear and completely transparent. The position of veterinarians and the profession must be clearly and definitively represented in ethical questions that involve the well-being of animals. Veterinarians should represent the moral balance of new technologies and practices that involve animals.

Values and ethics are an integral element in the fabric of the profession, and influence the role it represents in

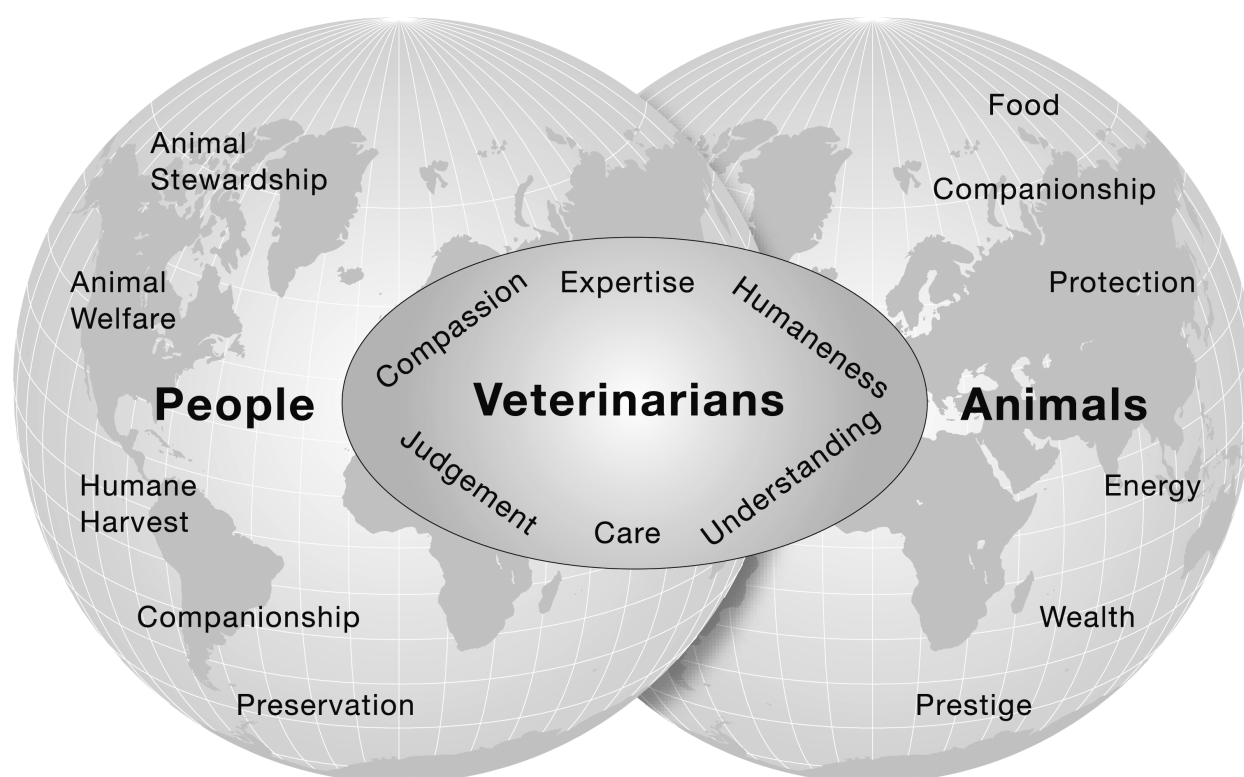
To be respected and valued by society, the public must understand and appreciate the uniqueness of veterinarians, the value that veterinarians provide to society and to the well-being of animals, and the core values of veterinarians. The public image of veterinarians must be expanded, not by replacing but by building on the beautiful and wonderfully accepted and respected image of the "Gentle Doctor".

Creating a Vision for Academic Veterinary Medicine An essay by Keith W. Prasse, 2005

society. As a result, values and ethics should be an integral component of education.

#### A Vision for Academic Veterinary Medicine

North American academic veterinary medicine is a global leader in the design and delivery of veterinary medical education systems. It inspires and educates veterinarians to exemplary standards and values in an intellectually and emotionally rewarding career. The profession is respected and valued by society for its leadership and dedication to the health and well-being of animals, people, and the environment.



**Figure 1: A future image of veterinarians**

#### A Future Image of Veterinarians

- Veterinarians work in society at the interface between animals and people.
- The “Gentle Doctor” is a powerful and compelling image of veterinarians in the psyche of the majority of the public.
- This is an image that should be retained and expanded and should be actively promoted.
- This emotional image touches people in a way that an alternate, more accurate, but intellectual image would not.
- The expansion of the image should encompass the multiple roles that veterinarians serve in society.

This future image of the veterinarian is depicted in Figure 1.

#### 6.2 PRINCIPLES CONSIDERED TO BE MOST IMPORTANT

Using Foresight technology, with its numerous exercises and group discussions, the many talented participants produced a broad range of insights, conclusions, and recommendations.

The objectives of this study were very focused and specific. Therefore, only the most compelling principles are presented here, and have been developed from all of the preliminary meetings.

1. Veterinary medicine must remain relevant to the changing needs of society.
2. Veterinary medical education can respond to these changing needs only by expanding the areas of education required to prepare the veterinarians of the future.
3. Veterinary medical colleges can achieve this expansion by identifying areas of professional focus, each leading to a DVM degree, and each perhaps identified within institutions as centers of emphasis, according to a national plan.
4. In addition to meeting the demand created by population growth, and increasing expectations for traditional services, the number of graduating veterinarians must be increased to allow the profession to respond to new demands and roles.

This increase could be facilitated by

- a publicity campaign to expand the image of the profession
  - a resolution of the perceived student debt load versus graduate veterinarian remuneration imbalance
  - changed admission criteria that match the needs of the expanded profession
  - a more flexible and adaptable program
5. Academic veterinary medicine should reflect the existing and anticipated diversity in society.



6. It is necessary that legislators and policy makers understand the extent of the value that veterinary medicine brings to the health and well-being of society and actively support the profession with appropriate legislation and increased funding.
7. There is an opportunity for veterinary medicine to capitalize on new technology for the delivery of education and veterinary services (e.g., analytical work, research, diagnostic sciences, and therapy).
8. Veterinary medicine should seek to achieve greater collaboration and cooperation with human health in the public health area, with veterinarians playing a more dominant role in the management of zoonotic disease, public health, and the impact on eco-system health.
9. The "One Medicine" concept is an exciting and logical future goal. It is concluded that veterinary and human health convergence must first be achieved before "One Medicine" can be realistically pursued.
10. Strategic partnerships and alliances are essential for academic veterinary medicine to be successful in the cooperative delivery of an expanded educational process and new areas of professional focus.
11. Modification of the national licensing system for graduate veterinarians, and of the accreditation standards for colleges of veterinary medicine, are fundamental to the acceptance and implementation of the required academic changes.
12. The public image of the veterinarian as the "Gentle Doctor" should be retained, promoted, and expanded in the current and new roles in society that veterinarians can play.
13. The status of veterinarians can be enhanced by
  - advocating for the well-being of animals
  - achieving and demonstrating increased competence
  - becoming more visible to the public
  - clearly defining the fundamental values and ethical standards of the profession
  - articulating the profession's position on significant and controversial issues in society that involve animals
14. The power and influence of the veterinary profession will be strengthened by achieving unity and speaking with one voice in matters of fundamental principle.
15. The public image and status of veterinarians will be changed only through a powerful and professional marketing and public relations campaign.

### 6.3 RECOMMENDATIONS

The participants in this study offered an extensive range and number of thoughtful individual insights and recommendations for change to the AAVMC. These have

been recorded in the preliminary reports and are also collated in Appendix D.

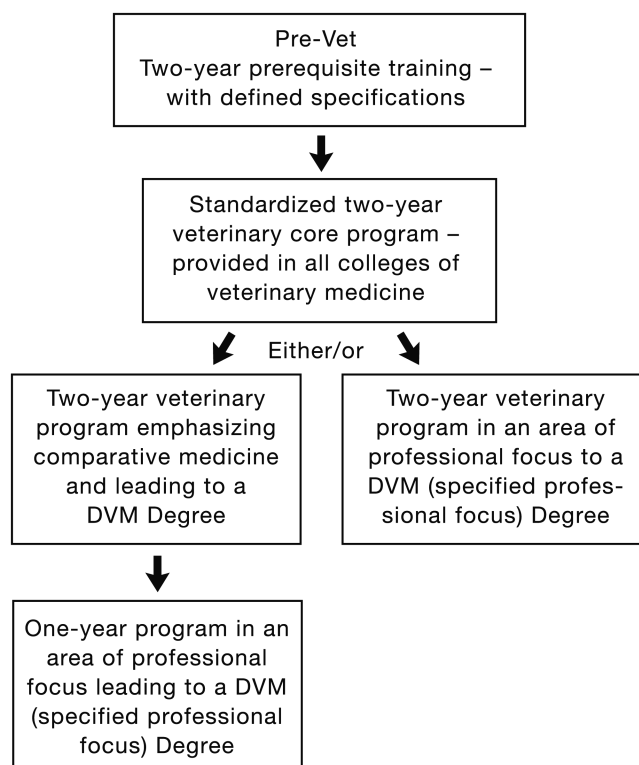
Here, we present a series of 45 recommendations for actions. These recommendations are based on the insights and conclusions reached during the course of the study. They are presented in categories deemed most pertinent for the AAVMC.

#### Education

1. As a first priority, the AAVMC must achieve consensus on two key points within academic veterinary medicine and the profession as a whole. The first is acceptance of the concept of an expanded veterinary medical educational program to be achieved through provision of areas of professional focus, perhaps identified as centers of emphasis in North American colleges of veterinary medicine. The second is an acceptance that veterinary licensure will recognize competence in selected areas of professional focus, and will lead to public assurance of competency in a selected area of veterinary medicine.
2. The AAVMC should develop a national strategic plan for implementation of the concept.
3. Each college should develop a specific strategic plan to achieve fulfillment of the educational concept at that location.
4. Within the national strategic plan, the AAVMC and the colleges should create a design for the concept of focused veterinary medical education. An example is illustrated in Figure 2.
5. It is recommended that the AAVMC and the colleges reach a decision on the program design and the length of the educational program for uniform implementation in North America.
6. The national plan should define the areas of professional focus required for both the traditional and anticipated future needs of society as well as the prerequisites needed for each focus area.

This plan will require the agreement and collaboration of all colleges.

7. Each college can choose and establish its areas of professional focus from those listed in the national plan.
8. The national plan should ensure that there is at least one center of emphasis for each defined focus area.
9. The national plan could predetermine the minimal number of seats required to respond to each area of professional focus.
10. The system for the granting of DVM degrees could be modified to allow the degree to be obtained by attending more than one college of veterinary medicine in a national cooperative program. Such programs would require inter-institutional agreements on residency, tuition, and fees.
11. The AAVMC and the colleges should promote the advantage of pursuing dual degrees in intensified programs.



**Figure 2: Examples for possible veterinary medical program designs**

#### Recruitment and Numbers

12. It is essential to the success of the concept presented here that the number of graduating veterinarians be increased to maintain the number of practitioners commensurate with society's needs, and also address under-served and new areas of practice.
13. The AAVMC and the colleges could pursue expansion of recruitment through publicity of career opportunities, increased awareness of the scope of the profession, promotion of the image of veterinarians, and appeal to the full range of diversity in society.

#### Admission

14. The criteria for admission could be modified to select for the broader range of skills required for future veterinarians.
15. Efforts should be made to attract students from other professional groups, who already have the desired prerequisite skills.
16. Selection for admission must consider achieving diversity in the profession, which would reflect the diversity in society. Achieving diversity within the profession will lead to a broader understanding of the profession and wider use of veterinary medical services.
17. Students could be selected for admission into areas of professional focus where they have a preference, up to the predetermined number of seats in that area.

18. The AAVMC could monitor on an ongoing basis the number of students nationwide in each focused area and could then predict response to anticipated societal needs. This comparison could be used as justification for proactive lobbying for support.

#### Student Debt and Remuneration

19. The AAVMC and the colleges should develop a plan to reduce the student debt load, at least in unfulfilled areas.
20. The AAVMC could conduct a study of the remuneration of graduate veterinarians to evaluate whether that remuneration is in balance with the investment in the education.

#### New Technology

21. Colleges should capitalize on new technology to provide distance education and to utilize virtual simulations in education. This will facilitate increasing the number of students in certain components of the educational program, and will support continuing education.
22. Colleges should actively promote the integration of technological advances into the delivery of professional services for such areas as remote access to expertise, research, diagnostics, therapeutics, bio-sensing, data collection and interpretation, and national and international cooperation.

#### Strategic Alliances and Partnerships

23. The AAVMC should form alliances with human health organizations to promote cooperation in the public health field.
24. The colleges could form partnerships with other colleges, departments, and disciplines on campus to expand opportunities for educational program delivery, and as well use cross appointments and adjunct faculty to deliver professionally focused subject matter and to increase teaching capacity.
25. The AAVMC and the colleges could form alliances with humane societies and other animal welfare associations to influence policy on the well-being of animals.
26. The AAVMC and the colleges should promote closer alliances among veterinary associations to produce as a profession more concerted joint efforts on relevant policy and societal issues.
27. The AAVMC could initiate a relationship with such international organizations as the World Organization for Animal Health (OIE), the Food and Agriculture Organization (FAO), the World Health Organization (WHO), and the World Veterinary Association (WVA), to influence the development of global standards in veterinary education.

#### Animal Health–Human Health Convergence

28. The AAVMC should aggressively pursue and promote the collaboration and cooperation of animal and

human health to more effectively and competently address the public health needs of society.

29. Although the blending of education for the medical fields has tremendous appeal and potential for the future, it is recommended that the "One Medicine" concept be actively pursued only when the convergence of animal health and human health has been substantially achieved. However, consideration could be given to initiating formal relationships with colleges of human medicine.
30. The AAVMC should pursue with the National Institutes of Health (NIH) the establishment of an Institute of Comparative Medicine.

#### **Image of Veterinarians**

31. It is recommended that the degree Doctor of Veterinary Medicine (DVM) be retained and not changed because of its firmly established recognition.
32. The public image of veterinarians as the "Gentle Doctor" should be retained, promoted, and expanded to capitalize on its broad appeal.
33. The AAVMC should promote this expanded image of veterinarians and make clear to the public the range of roles that veterinarians play in society, and the value they bring to society.

#### **Marketing and Public Relations**

34. A key recommendation is that the AVMA/CVMA, along with the AAVMC, must aggressively market the image of veterinarians and seek to elevate their status and influence in society. This would involve a professional marketing and public relations campaign to promote veterinarians' roles in and contributions to society.
35. The marketing campaign should also promote the image of veterinarians so the public can understand the core values of veterinarians, what they do, and the unique training they have in comparative medicine, as well as their essential role as members of society's health care team.

#### **Lobbying**

36. The AAVMC should intensify lobbying to state, provincial, and federal governments to secure increased support through legislation, policy, and funding for the new, enhanced, academic veterinary medical program. Lobbying is a tool to broaden political understanding of the scope of veterinary medicine.
37. Within the limits of their 501-c-3 status, the AAVMC could consider engaging more lobbyists to acquire this support.

#### **Funding**

38. The AAVMC as well as the colleges should aggressively pursue increased funding from industry and foundations to support the new concept of veterinary education.

39. The AAVMC and the colleges could pursue increased funding for research via collaborative research projects in public health, from the Department of Homeland Security, and from pharmaceutical companies.
40. The AAVMC and the colleges could pursue increased student funding through increased scholarships, and through the payment of tuition by governments, industry, and rural communities for students in deficient areas in exchange for service in those areas for agreed periods of time after graduation. These include such areas as food supply veterinarians, preparation for crisis management, public health, public security, and eco-health.

#### **Licensing and Accreditation**

41. The licensing boards, through the American Association of Veterinary State Boards and the provincial veterinary associations, should address the modification of licensing for graduate veterinarians to allow licensing for an area or areas of professional focus.
42. The AAVMC should also ensure modification of the accreditation system for colleges of veterinary medicine, to recognize that all colleges will not teach all focus areas. Therefore the accreditation of a college must be limited to the requirements to teach the core program plus only the areas offered at that college. Because certain areas of professional focus may require attending more than one institution, accreditation standards will have to consider the pathway rather than the institution itself.
43. Changes in the licensing and accreditation systems are absolutely essential for the successful evolution to the new concept of veterinary medical education.

#### **Unity of Voice for the Profession**

44. The AAVMC should initiate a cooperative arrangement with the AVMA and the CVMA to ensure that there is one voice that speaks for the profession.

Ideally this should be extended to include other organized veterinary associations.

#### **Ongoing Change**

45. The AAVMC could consider monitoring ongoing changes in society, in political systems, in the environment, and in disease, to assess any potential impacts on the future direction and education of the profession.

This monitoring could be addressed through think tanks, consultancies, or corporations.

The AAVMC could also conduct periodic reviews from a future perspective to determine if significant shifts in educational direction should again be contemplated. These could be done using Foresight technology or some other methodology that has a future orientation.

# 7. The Future Direction of Veterinary Medical Education

## 7.1 THE SOCIETAL CONTEXT

Society, the environment, technology development, agricultural development, the emergence of disease, the human–animal bond, and culture are all rapidly changing. Veterinary medicine must adapt and respond to the changing needs of society, to remain relevant. The dynamics of social change are unstoppable, but the success of the profession will be determined by how well it meets society's needs. To meet these changing societal needs, the colleges of veterinary medicine must broaden the scope of the education they provide; however, no college should be expected to deliver education to veterinary medical students in all areas of professional focus deemed necessary to meet societal needs.

The structure of curricula should be designed to accommodate adjustments or change as future challenges unfold.

For veterinarians to be recognized and remunerated for their knowledge, compassion, integrity, and judgment, they must first demonstrate relevance to new societal trends. This relevance will grant legitimacy to the profession and will lead to authority. From this authority will come the respect and status warranted by the unique education of veterinarians.

## 7.2 TOWARD A RESPONSIVE AND FLEXIBLE VETERINARY MEDICAL EDUCATIONAL SYSTEM

The objective of this study was to determine a future direction for academic veterinary medicine that would prepare veterinarians for the opportunities and possibilities that could emerge within the next 20 years.

The study analyzed multiple aspects of the veterinary profession, its relationship to components of society, and the veterinary medical educational process. The method used was Foresight technology, which seeks perspectives from the future rather than extending thinking from the present. It involved the expressed opinions of over 95 participants, together with those of eight members of the Norm Willis Group Team.

Stimulated by exploration of the eight plausible, future scenarios, a system of veterinary medical education was proposed, which is believed to be responsive and flexible enough to allow the academic community to adjust to any future challenge.

However, fundamental changes in the education of veterinarians are required in order to create such

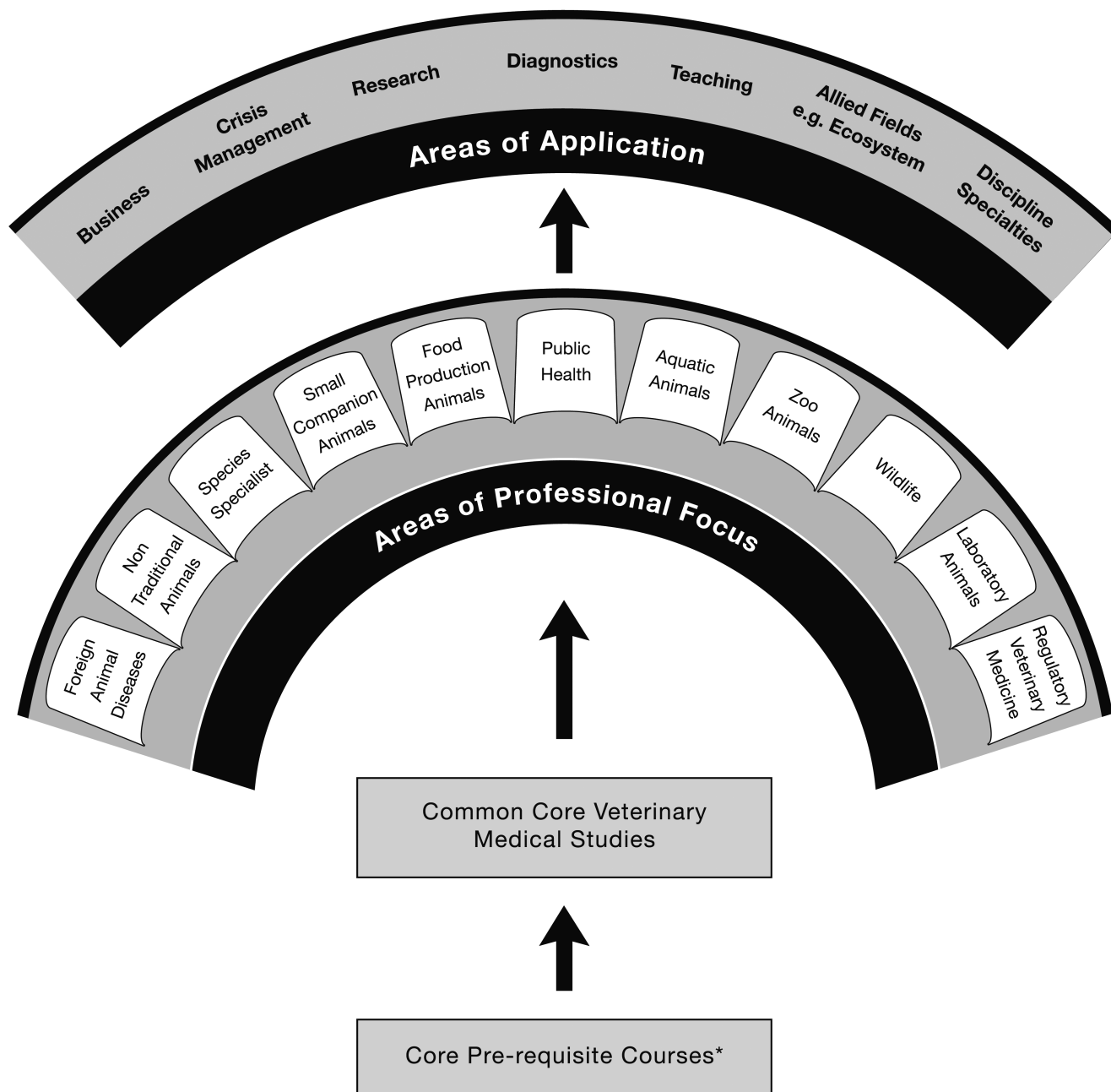
a system. Key issues that must be addressed include the following:

- Without significantly increasing the length of the education program, it is not possible for individual colleges to provide the requirements to meet all of the anticipated needs.
- The concept advanced in this report is for an adaptive and responsive system of veterinary medical education, achieved by defining the areas of professional focus, which would address all of the anticipated needs of society. An area of professional focus signifies a pathway leading to the DVM degree (see Figure 3 for Possible Pathways of Focus in Veterinary Medicine).
- Colleges would establish curricula offering selected areas of professional focus most appropriate to their capabilities. Certain areas may be identified by institutions as a center of emphasis. A national plan would ensure that all such defined areas of focus would be available on the continent in at least one center of emphasis. Experts would also be centralized in appropriate centers of emphasis to create leading-edge critical masses of expertise. Certain centers of emphasis may require participation by more than one academic institution. Such programs would require inter-institutional agreements on residency, tuition, and fees.

This would require the AAVMC to plan on a collective rather than an individual or competitive basis.

- Selection and admission of students would require that the profession ensures a predetermined minimum number of seats in each area of professional focus. The curricula would be modified to reflect the new areas of professional focus, and to permit controlled selection by students. The option would exist for a DVM degree to be earned by attending multiple colleges through an active, national, cooperative program.
- Accreditation of colleges would be altered to allow focused educational delivery in some areas but no delivery in other areas.
- Licensing of graduate veterinarians would recognize competency in various areas of professional focus.

## Possible Pathways of Focus in Veterinary Medicine



\*May require non-traditional components (e.g. communication, leadership, business, community development)

**Figure 3: Possible pathways of focus in veterinary medicine**

### 7.3 NEXT STEPS FOR IMPLEMENTATION OF THE EDUCATIONAL SYSTEM

First of all, develop a consensus that the expanded vision of academic veterinary medicine is required within the colleges of veterinary medicine, and broadly within the veterinary profession of North America. (AAVMC)



With the consensus in hand, a national strategic plan is desirable to bring the concept into realization.



A national plan for academic veterinary medicine could be developed collaboratively across the continent. To produce this plan, decisions are required on:

- which areas of professional focus should be developed to cover all the required needs of society (AAVMC)
- which colleges would choose to develop specific areas as centers of emphasis (colleges)
- what is the minimum number of seats that should be reserved for each focus area (AAVMC)

- what are the steps required and what is the length of the program to achieve a Doctor of Veterinary Medicine degree (AAVMC & colleges)
- an agreement to obtain a DVM degree through attendance at multiple colleges, but with a common core program (AAVMC & colleges)

A specific strategic plan is required for each college reflecting the change in curriculum needed to provide the necessary training, skills, and source of knowledge for each selected area of professional focus. (colleges)



The purpose of licensure is to provide assurance to the public of competency and knowledge for each selected area of professional focus. A consensus will be needed to change the process of licensing to recognize the “professional focus” designations of graduate veterinarians on a national basis. (AAVMC)



The standards for accreditation of colleges should also be modified to reflect their status as offering certain selected areas of professional focus. (AAVMC)

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## 8. Epilogue

In this Final Report, we have taken into consideration the vast amount of material produced, and the many comments and opinions expressed during all four working meetings. Drawing on the wide range of experience of the more than 95 participants and on that of our Team, we analyzed all of this input material and summarized it in this report. The prime result is the selection of key conclusions and recommendations that we consider to be of most value to the AAVMC and the veterinary colleges in determining their future.

This study has explored multiple, possible futures for veterinary medicine and has used this exploration to produce

- conclusions
- recommendations
- an image of veterinarians and of veterinary medicine
- a future direction for academic veterinary medicine

And it has offered a vision for veterinary medical education.

This was a fascinating study in which the invaluable and freely given advice of the many participants who believed in the study and who wanted to make a

contribution was essential. We are deeply grateful and respectful of this stellar and enthusiastic display of concern for the veterinary profession and for the education of veterinarians.

We also offer our sincere gratitude for the support of the staff and Executive of the AAVMC. We are honored to have had the opportunity to be part of this study and admire the leadership that envisioned the need.

The veterinary profession and veterinary medical education are at a transition point. Either a decision to broaden the scope and potential of veterinary medical education, or a decision to retain the present system, will be made.

From all perspectives, society and the needs of society are profoundly changing.

Veterinary medicine has a proud and admirable history with many achievements in which it can take pride. It is integral to—and has so much that it can offer for the well-being of—a future society.

This is a pivotal time for the profession. Leadership, collaboration, and a shared vision will determine its destiny.

# Acknowledgments

Dr. Lawrence Heider, executive director of the AAVMC, was the inspiration for this study into the renewal of academic veterinary medicine in the United States and Canada. It was his insight and dedication that recognized that if academic veterinary medicine were to address the dilemma it was facing, and reach its potential, it would have to redefine a new future direction for itself, and that the time for this was now. Dr. Heider realized that a different process would be needed to achieve the innovative thinking that such a new direction demanded. He identified Foresight technology as the best approach to accomplish this and staunchly supported its development throughout the whole process.

The achievements of this report are a direct result of his leadership and of his belief in the important and fundamental role that academic veterinary medicine can play in our society, both today and in the future.

Dr. Keith Prasse's role, as manager of the AAVMC Foresight Project, was to assure the smooth progression of the study and to serve as the essential link between AAVMC and the consultant team. Dr. Prasse's belief in the need for and timeliness of this study was critical for its success, and his dedication to the fulfillment of its potential, from concept to final report, is gratefully acknowledged.

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## Notes and References

### NOTES

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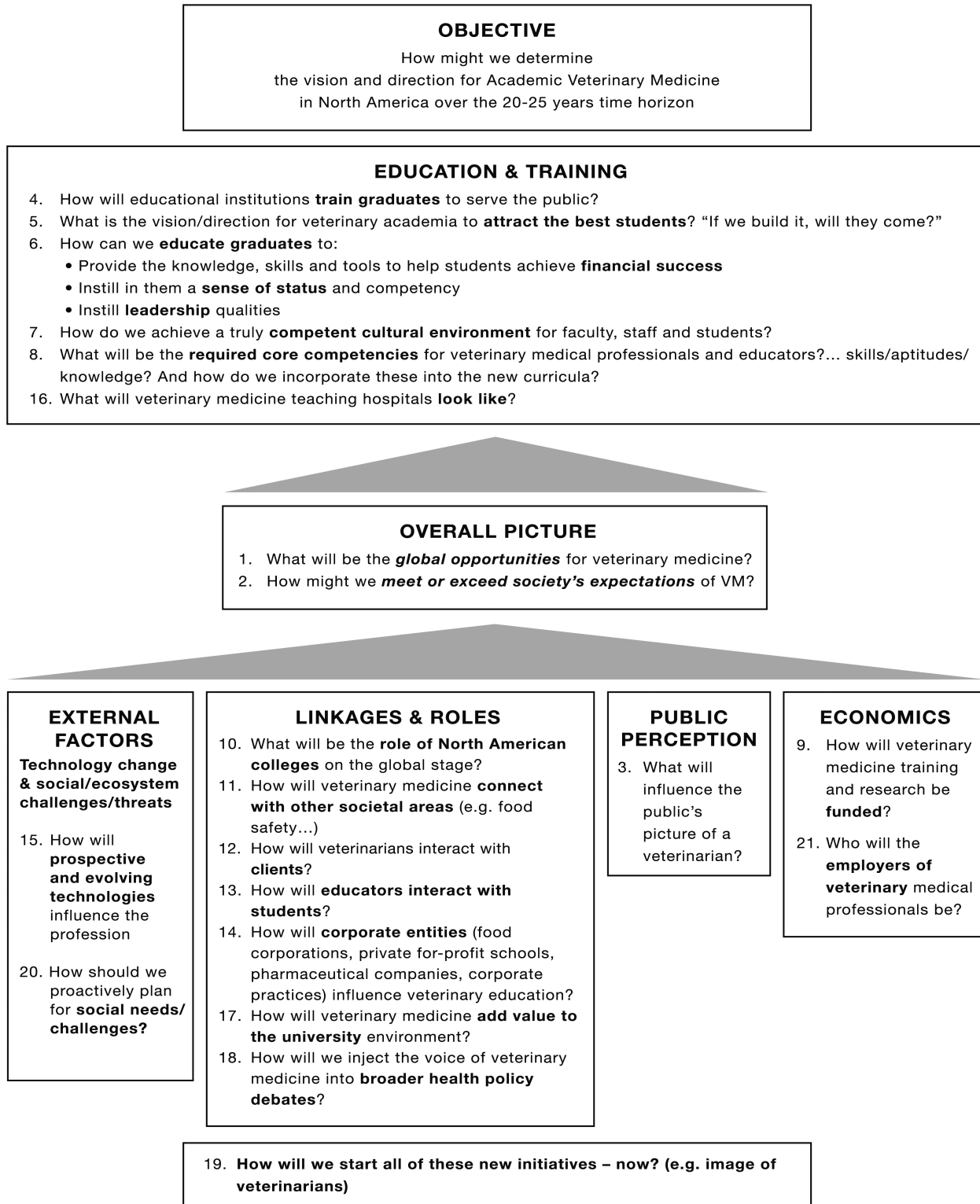
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# Appendix A: Challenge Map of 21 Questions Developed by the Initial Synthesis Group for the Project Definition (Section 2)



# Appendix B: Challenge Questions Given to the Fort Collins and Knoxville Workshop Participants (Section 4)

## FORT COLLINS WORKSHOP

### 1. Societal Expectations

- In 2025, will society accord veterinarians a broader or narrower scope of responsibilities?
- Will society place a higher or lower value on the veterinary medical profession?
- If society develops much stronger, or more polarized sets of values with respect to animals, what will have led to these shifts? How will veterinarians respond?
- How well will academic veterinary medicine fare in having a population of students and faculty that reflect the cultural, ethical, and racial diversity of society? What actions and strategies will have led to this state?

### 2. Education Format and Delivery

- Assuming that the education system transitions to primarily virtual (online) information dissemination, which areas of academic veterinary medicine would continue to be best served by real interaction? Why?
- Who will manage standards and certification of veterinary professionals in a future global pay-to-learn environment?
- How will increased ethnic/cultural diversity in society impact the role, skills, and knowledge requirements of veterinarians in 2025?
- What will be the major differences to colleges and AAVMC between 2006 and 2025?

### 3. Business Models

- What are the dominant business models of ownership and control of veterinary practices in the future (e.g., companion care vs. food supply)?
- Does the control and ownership of veterinary practices (i.e., the delivery of veterinary services) impact the quality of veterinary (professional) care provided to patients? If yes,
  1. How does the non-veterinarian control of veterinary practice change how the care will be provided (e.g., quality of care, use of technology, etc.)?
  2. What will happen to compassionate care when others than veterinarians control the business?

3. How will the need evolve for insurance programs for animal health over the next two decades?

4. How will these changes to the business model impact the training of veterinarians of the future?

### 4. Ethics and Values

- Will the veterinary oath in 2025 be different from what it is today?
- What ethical issues are likely to emerge from the generation of genetically engineered animals, xeno-transplantation, nano-biomedicine, etc.?
- How should the veterinary profession position itself to strongly influence decision making on ethical issues with regards to:
  1. societal expectations for health-related professionals
  2. the role of the veterinary colleges
  3. the training of veterinarians
  4. veterinarians' role in public health and pandemics protection

## KNOXVILLE WORKSHOP

### 5. Science and Technology

- How should the veterinary profession and veterinary colleges prepare for and accommodate new, innovative, and challenging capabilities?
- What kind of impacts do you think the technological innovations that have emerged in 2000–2006 (e.g., Internet, Google, Wikis, virtual medicine, robotics, smart networks, biotechnology, genomics, proteomics, nanotechnology) will have on the profession and on veterinary education as they evolve to 2025?
- What new types of innovations can you see emerging that may also have major disruptive impacts on how veterinary medicine is practiced and taught?
- In 2025, will veterinarians become more like technical advisors to innovators, coaches to animal owners, and support scientists to synthetic food producers, or how may the profession redefine itself in other ways?

- What new capabilities and technologies do you think will be possible/desirable for veterinary medicine in 2025?

#### **6. Status of Veterinarians**

- What are the critical elements that influence the status of veterinarians today and what will be the elements in 2025?
- Do you believe that the status of veterinarians will be higher or lower in 2025? In what ways do you see the status changing?
- The role of veterinarians in 2006 is strongly influenced toward companion animals. Do you see a major shift in this trend in 2025?
- How do you think that veterinary colleges and educators will help to elevate the status of veterinarians?

#### **7. Relationship with Public Health**

- Will the role of veterinarians and veterinary medicine be expanded or increased in 2025 over that of 2006 (in the context of public health)?

- What will cause these role changes?
- Will there be resistance to this kind of expansion? How could it be overcome?
- What role would veterinary colleges play in supporting such an expanded role?

#### **8. Policy, Regulation, and Funding**

- What will be the impacts of a funding scenario where public funding of academic veterinary medicine is directed only toward support for public health issues?
- What will be the impact of tasking the private sector with providing the education necessary to support industrial food production?
- How does this divergence in training (public health/ industrial production) impact the overarching role of the veterinary professional?
- Are there potential conflicts between sectors within the profession? For example, are private-sector veterinarians conflicted in the struggle to ensure a safe food supply and a prosperous industry? Are public health veterinarians pitted against industrial veterinarians?

# Appendix C: Scenario Descriptions

## C1. DOOMSDAY: THE PANDEMIC DISASTER OF 2015–2025

Keith Smith had just returned from his 17th vaccination for a zoonotic-based disease in as many years. After the great scare of mad cow disease or BSE, there had been the chicken hemorrhagic fever disease, swine influenza, avian flu, raccoon fever, and many others, including Ebola from rats. Each new wave brought a more frightening array of symptoms and a growing risk of mortality, and further weakened the public health system. Public confidence in the government's ability to deal with these crises was at an all-time low. Many of these pathogens were unknown previously in North America, but became widespread with the increasing temperatures and the growing frequency of extreme weather events such as hurricanes and flooding. The increasing number of pandemics was an unfortunate side effect of global warming.

The war against terrorism of some 20 years ago was long forgotten. The new enemy was invisible, microscopic, and viral. Over the last two decades, a fifth of the global population had been eradicated by disease. And the overwhelming majority of these illnesses came from animals. The times were eerily reminiscent of the great plague in 13th-century Europe.

Keith was the outgoing secretary of the Pan-American Association of Veterinary Institutions of Higher Learning. He was looking over the final draft of the annual report. A slow sinking feeling overwhelmed him. He couldn't help notice that for the 25 years of his involvement with the association, membership continued to fall. Of the 35 college and university faculties that taught veterinary medicine in 2007, only a third remained, and half of these were struggling just to keep their doors open. He looked at the Board of Governors. Not one of them was a deputy secretary or assistant secretary at either the state or federal level. Not one of them had achieved a public profile of any note. And worse, not one was seen to be taking part in the critical national debate that was tearing up the country in determining how to respond to the growing number of pandemics.

He glanced at the electronic news headlines flashing across his screen, reporting on the various speeches of municipal, state, and federal officials concerning the latest pandemic. He was struck that there was no mention of the animal sources of these pandemics or how to manage them. This wasn't surprising, since not one of them was a veterinarian or had been trained in animal health. They all talked about human vaccination, clinics, health care, and possible evacuation programs—but not the source of the problem. One county judge tried to halt the import of animals from Canada, the Homeland Security advocated destroying all cattle, and one state official in agriculture was calling for yet another strategy: systematic screening of all meats sold in the retail outlets for possible pathogens. He shook his head.

How could they miss the obvious? If you control the wellness of the animals to start with, vaccinate them, and keep their population healthy, you control the primary infection vector. That's what veterinarians used to do.

He remembered the fierce debate 15 years ago over the association's participation in a government-funded panel to look at the future of life sciences. The view that prevailed at the time was *not* to join the panel: "We should focus on pets and companion animals—that's the future of our profession—and not get involved in the airy-fairy world of public policy." Any more involvement in public health—or tampering with the classic curriculum by adding public health and emergency preparedness—should be discouraged. The focus was on the processes and clinical routines the profession knew best and had served it well over the last fifty years. There was blood in the boardroom—almost half of the directors resigned in protest. That was a watershed in the history of the 75-year-old association. In hindsight, the association had missed an invaluable strategic opportunity for political networking and power building. It also missed the boat in failing to lead and innovate in the fight against one of the biggest threats that has ever faced the nation.

Yet, as he looked again at the numbers in the annual report, he still saw the need for his old profession. For every available graduate, there were 10 vacant positions in universities, government agencies, or public health departments. They all asked for people with either knowledge of animal physiology, animal health, or epidemiology—but did not call them veterinarians.

This shortage was easy to explain. Government funding for veterinary schools had been slowly diverted to more pressing home security and social and health benefit programs. As businesses closed and the economy collapsed from the growing number of pandemics, pet ownership became an unnecessary luxury. Worse, pets and farm animals were perceived as the enemy and were destroyed indiscriminately by the National Guard and municipal police.

Graduating vets, trained exclusively in companion pet care, had no jobs, no private practices to go to. They had been unable to retool their skills to the needs of the new social realities. In the spreading panic, there was no effort to apply any scientific criteria or risk assessment. All veterinary research centers on the continent had effectively closed down over the last 10 years. Even the prestigious World Organization for Animal Health, once the ultimate authority in major animal disease disasters, was silenced because of lack of funds. There was no longer any scientific authority to speak knowledgeably about the health of animals or their diseases. Animals that were known to be healthy and even valuable were destroyed indiscriminately on site. Seniors, whose only living supporting companion was

a dog, had their pets literally torn from their arms and destroyed on the spot.

Many of Keith's colleagues from vet school of 40 years ago had to close their practice, not only because of government restrictions on pets and animals, but also because they had lost the public's confidence. Their respective communities saw them as somehow linked to the wave of pandemics. There was absolutely no evidence to support that, but in the ensuing panic and witch hunt, rational discourse was a rare commodity. A sorely underfunded publicity campaign by the association to try to turn that view around went nowhere.

Keith closed the file and glanced one more time at his resignation letter. This was a losing battle.

## **C2. THE GREAT ANIMAL PEACE: ERADICATION OF ZONOTIC HEALTH THREATS**

Dr. Jack Armstrong was about to receive an honorary doctorate from Harvard University. As he sat onstage during the commencement ceremony in Harvard Yard, surrounded by century-old redbrick buildings and majestic trees on this sunny June afternoon of 2027, he reflected on the events that led to this momentous occasion. He would soon join the ranks of an international elite group that included presidents, kings, queens, and Nobel Prize winners.

Jack was about to retire as secretary of the new Federal Department of Living Wellness. He had served under two presidents, and shaped the basic structure and direction of that agency that brought human and public health together with veterinary medicine. It represented a breakthrough in political thinking, where for the first time all living beings were recognized as forming a tightly integrated biosphere. People depended on animals, and animals depended on people. This new relation was reminiscent of the harmony that descended on the Roman Empire, the great roman peace or Pax Romana.

Four out of six of his assistant secretaries had attended the three-year core curriculum at Napa Valley Veterinary College (NVVC). Set among the beautiful vineyards of California, the school was the first to offer an integrated approach to wellness training of all living beings, human and animal. Basic biochemistry, physiology, cell biology, microbiology, epidemiology, and pathology were taught from a comparative perspective, before students went on to research and certification. With this approach, they could appreciate the dependencies of one species on another, and learn the vital team approach to solve problems that was the operating philosophy of his agency. Other courses included political science, leadership, and above all, communications. One way in which the NVVC alumni distinguished themselves in Washington was the exceptionally articulate way in which they expressed themselves on almost any issue. In fact, they became the preferred spokespeople for the press. That ability was certainly worth the increase in private financing while still maintaining funding from government regulatory agencies.

Jack stared at the thousand young and eager graduates sitting in the courtyard. In a couple of hours, each one of them would walk away with a diploma with the Harvard University

seal that would mark them for the rest of their lives. He also noted that almost everyone had a public health RF-ID tag that captured and reflected the 23 health parameters. This was a voluntary program, but 98% of the students subscribed to it. As a result, the rate of infectious diseases in the student population, from the perennial flu that used to plague the campus, all the way to STDs, was dramatically down. Other parameters including nutrition, exercise, and other physical activities were also monitored.

In a similar way, each and every single animal longer than six inches in North America had a similar electronic RF-ID tag injected at birth. In addition to basic wellness parameters, the tag helped to pinpoint the animal, thanks to the new generation of LifeForm Radars. His agency could track any dog, cat, hamster, pig, bird, cow, and other ruminants, and even migratory birds in real time. This massive amount of information was filtered through the agency's computer and fed into the North American Zoological Wellness tracking model. This predicted all the major biological parameters of wellness throughout the continental zoosphere, from population levels, state of health, to any potential future risk of disease outbreaks. Deviations from the wellness parameters, especially anything related to a potential zoonotic pathogen, immediately triggered an alarm and set off a well-programmed response at the local level within hours of the first infection.

As he caught a glimpse of the research buildings far away on the campus over the trees, he reflected on how much his own alma mater had changed. Over half of the faculty was now actively involved in research, and much of it was fundamental research too. That held true for most of the other colleges as well. He also reflected on how many of the graduates, once they had finished the core curriculum, went on to become specialized and certified in such areas as electronics, genetics, epidemiology, public health, and even business administration. Most received monthly educational update packages as part of continuing education.

There had been no significant outbreaks of animal or zoonotic illness for at least 15 years. Salmonella, E. coli, and other animal-based illnesses had vanished. Animal meat was so safe that Jack had no hesitation to order the steak tartar at the Faculty Club cafeteria later that day, a great delicacy that was considered safer than breakfast pancakes. As a result of increased surveillance, the price of any meat product was getting close to unaffordable, even on his executive expense account. However, whenever he had the opportunity, he simply relished it—that was one of his few sins. This high price did give rise to black-market initiatives, and increasing attempts to sell knock-offs. He just read about the police crackdown on a soya ring, which sold counterfeit sirloin steaks made from cheap vegetable protein that was almost indistinguishable from the real thing.

Jack reread the citation for his honorary degree: "For extraordinary services to the nation and the American people in dramatically reducing harm from animal based diseases, and bringing about a new symbiotic relationship between humans and the animal world." He could not have said it better.

### C3. BRAVE NEW WORLD OF MODIFIED SPECIES

Jennifer McIver drove her souped-up solar-powered BMW 3000 through the third checkpoint barrier of the brand new high-security American Genomics Laboratory International campus in Kentucky. AGLI's was the highest-security establishment she ever worked for in her life, even higher than the level 4 bio-security laboratory of the CDC. And there were good reasons for it. The AGLI campus housed the single largest facility for genetically engineered new animal species. As vice-president, New Product Development, it was her job to determine which new species her top-notch research team would develop, a species that would feed the almost insatiable need from an ever-demanding global market, and generate the maximum ROI for AGLI. Once the market discovered the richness of features and customizable benefits from non-traditional animal species, demand for AGLI life-products soared.

By far the most visible building on the campus was the food-producing animal facility, which generated new species of what used to be bulls, cows, and pigs. The new animal—called for now "Beta-301"—had all the desirable qualities of the meat-producing cow and pig, without any of the undesirable ones. Firstly, it was guaranteed to be entirely disease-free. With a proper chemical nutrition cocktail developed by AGLI scientists, the 301 could also reach full maturity in four to six months. Most of the muscle mass in the 301 produced meat cuts that were as lean and tender as the best sirloin with almost zero fat. Elimination was funneled to a tube directly into fermenters, which extracted valuable carbohydrates and fibers. Best of all, no methane or other greenhouse gas was liberated into the atmosphere, making 301's ecological footprint smaller than a mouse. And lastly, to placate increasingly antagonistic animal rights groups, the anxiety center in the 301's brain, which would generate high stress in a normal animal as it entered the slaughterhouse, was genetically eliminated. While the initial capital cost of an embryo was two orders of magnitude more than for older bovine models, the overall production economics, including shortened maturation period and far superior meat, made it a most attractive financial option for food producers. They did need special facilities to house the new 301s, however, which meant a significant capital outlay.

Next was the companion pet facility, where designer pets were bred for increasingly demanding and rich owners. Costing as much as a luxury car, a designer pet could have any mix of desirable physical features, such as color, size, and shape. Clients placed their orders through the online catalogue. The latest features were the implanted behavioral and emotional profile, which, thanks to a sample of DNA from the future owner, could be made totally compatible with the new master. This feature was particularly valuable for seniors, who required specific temperament features and emotional profiles for their companions. A good emotional owner-pet fit in the case of seniors could reduce hospital and other health care costs by several hundred thousand dollars.

There was also the plant for growing replacement organs and tissues for an increasingly aging population, and the pharmaco-genomic production area, where customized

genetically compatible drugs and other therapies were being grown.

AGLI invested extensively in research but also in telling the community about its research. As vice-president, Jennifer spent a great deal of time on the lecture circuits and appearing in the media, explaining the low risk of AGLI's new line of species. One sensitive ethical issue she always had to answer was, "Are we playing God in engineering these new species?" Her standard answer was that since the beginning of history, people have always tried to improve food animals—today, the only difference is the technique.

She remembered her father telling her about the announcement in the White House 25 years earlier by President Bill Clinton about the first mapping of the human genome. Today, not only had the genome of every significant animal species been mapped, but the original genomes of the traditional species had been perfectly preserved. AGLI's proprietary recombinant techniques now allowed scientists like Rashi Ayoub, who worked for Jennifer, to add and subtract genetic traits at will, as easily as assembling the plastic colorful blocks of that old children's toy, Lego.

When Jennifer completed her core program in veterinary and biomedical health 15 years ago, genomics as a driving factor for the industry was only beginning. A few companies were able to generate exceptional investor interest and reached overnight capitalization in the billions. AGLI was one of them.

Jennifer's boyfriend at the time urged her to take additional modules in genetics and biochemistry, as well as an MBA specializing in finance and organizational skills. This led her to the prestigious global certification program in Animal Wellness Leadership allowing her to find a job anywhere in the world. That combination of scientific/biological, business, and leadership skills made her a most attractive recruit for a growth-oriented and strategic firm like AGLI. She was the 46th hire. Today, the company employed 30,000 people across the world, mostly in sales, distribution, and after-market consulting and education. These functions were covered by people with certifications and licenses in epidemiology, business processes, or public education, over and above the core curriculum in animal bioscience.

Public education was an important part of AGLI's success. New species of animals required care very different from that provided for traditional animals, and owners had to unlearn many habits in rearing animals—habits that could prove disastrous, especially on the nutrition side. But more important were the extensive safety precautions and post-marketing surveillance network AGLI had put in place, to protect and quickly neutralize any unwanted side effects from the new species. They paid special attention to possible risks from harmful viral infections or other unanticipated side effects, especially in the organ replacement and pharmaceutical products.

She sat down in her glass office, admiring on one side the exquisitely landscaped rolling hills of Kentucky, and over-seeing on the other side the rows and rows of iridescent fermenters inside the plant.

#### **C4. FRAGMENTED PROFESSION**

John Andrews was traveling to the fifth reunion of his Animal Wellness College (AWC). The two-year intensive core-training program at AWC was a watershed in his professional career. For one, he took most of the training courses 2,000 miles away from the actual AWC campus at the multimedia studio of his local university. From the core modules, he learned the basics of anatomy, physiology, and pathology of 20 different species of animals. He was able to handle them, feel them, and even operate on them from the comfort of his own 3-D sensory manipulator. His subsequent two-year specialty training in small animal practice, which earned him a certification as a Small Animal Veterinarian, allowed him to open his own practice in caring for people's pets.

When he received the invitation, he was frankly surprised to see where all the members of his virtual team ended up. He was even more surprised at the median salary level for the class. Almost all his former fellow students went to another institution after AWC. Among all of the technical specialists, he was the only one with a DSAVM, Doctor of Small Animal Veterinary Medicine.

Jill Epstein, who by far had the highest public profile of the class, appeared on the national news at least once a month. She was the new National Wellness Secretary in Washington. She carried more weight on national policies in relation to human and animal health than the whole class put together. Her post-core specialization was in Public Wellness Policy.

Jack Short was working for Animal Engineering Inc. (AEI), a fast-growing biomedical research center working on disease-free novel breeds for food. He did a research specialization.

And Christian McDonald became the spokesperson for the animal environmental protection group that worked on reducing methane emissions from animals. His concentration had been environmental zoologics and communications.

But by far the wealthiest of them was Monte Rhodes, VP Business Development for the largest chain of vet wellness centers in the world, who went on to do a specialization in Animal Business and Marketing. He remembered a recent conversation with Monte, when his friend shared with him the latest campaign to increase profitability in the company. "You see," said Monte, "we need to encourage our clients to go for the new chemotherapy package for their pets, as an alternative to euthanasia. Not only does it extend the lives of their precious ones by at least six to eight months, but also the margins are astronomical. Our shareholders love it."

Despite the physical distance separating them all during the core training, the frequent virtual meetings and debates between them over the two years had made them friends for life. They still connected with each other at least two or three times a month, to catch up on their work, their families, and where the profession was going. But the veterinary profession had become an increasingly futile topic to discuss, because there was no longer a profession as such. Jill's work in Washington had little or nothing to do with John's own day-to-day practice helping seniors live comfortably with their companions. And Jack's new work at AEI, where he dealt on a day-to-day basis with the

molecular dimension of animal life, had nothing in common with their reality. Monte's language about his business was no different from that of any senior executive of a multinational corporation.

While they all shared the common core curriculum of AWC, the post-AWC specialized training and certification had ultimately shaped their careers. The overload of specialized skills and technical information made it impossible to have one homogenous degree anymore. While more traditional veterinarians had fiercely resisted it, the new segmented concentrations and certifications had been finally approved by an act of Congress in 2015. One benefit was that there was now a single, consistent set of national certifications for those working in animal health and biosciences. But many of the traditional veterinary colleges opted to focus on only one or two of the 17 new areas of concentration.

One change that made John's work significantly easier was the growth of the new animal paraprofessionals—young people with a two-year post-high school diploma in animal technology. Without them (he had seven on staff) he would have been able to handle less than a third of his current patient workload. Six of the seven took their distance training from AWC. Five came from outside North America—Africa, India, and Southeast Asia. The cultural diversity of his recruits was a direct result of a global advertising campaign five years ago by the Animal Wellness and Bioscience association to increase the breadth of the student population going into animal bioscience.

As he parked his car near the new reception area for AWC, he was looking forward to the banquet, and to the special hybrid no-fat, no-cholesterol sirloin steak that was on the menu.

#### **C5. ONE MEDICINE, ONE HEALTH**

Sarah Clark was driving home from work. She had just left the Southern American Center for Health And Wellness, where she occupied the post of chief wellness officer for the southern free-trade area of North America, which covered what used to be the southern states of the US and the northern part of Mexico. She coordinated the activities of 12 pan-disciplinary teams at the center, which covered all the major themes of biomedical wellness for the region—animal and human. It was 10 years since she completed her certificate in biomedical health sciences in California at the Sonoma Health Sciences College. At the time, this was still a new core curriculum for all professionals involved in health sciences, covering humans and animals. A third of her classmates turned out as physicians and medical specialists, some went into the traditional veterinary sciences, and a good many became senior public health officials.

But one thing that stood out from her training was the skills and leadership ability the school gave her in working and resolving problems with specialists and professionals in other disciplines with different training. This teamwork was particularly important now as her center was wrestling with a new outbreak of mad chicken disease (MCD). The last serious outbreak of avian influenza was over two decades ago and had killed several hundred thousand people, including senior citizens and children throughout the world. Thanks to the latest sensors and remote satellite

diagnostic tools, the center was able to pinpoint an outbreak of MCD within 24 hours of the first infection in a human, a 12-year-old girl named Lily. This took place in the remote region of Mexico called Pacias. Within six hours of the alarm, Lily was being treated in an isolation clinic with her parents, and a SWAT team of microbiologist and veterinarians had already identified and quarantined the two diseased chickens that were the source. Lily's parents had no idea that she was ill or had caught what could have been a serious disease. All they noted was that she woke up that morning with a cough. It was the vapor spectrometer and microbial detector at Lily's school that triggered the alarm.

Sarah could remember her professors at Sonoma telling her of the last avian outbreak at the beginning of the century, when old-school veterinarians were not consulted, and public health officials worked in isolation from physicians and field workers. It took three months before a unified government response could be mustered. Hundreds died before that happened.

On a day-to-day basis she worked with epidemiologists, microbiologists, infectious disease specialists, large and small animal veterinarians, public policy officials, and public health specialists. What made communication with each one of them so easy was the core curriculum and biomedical health sciences that they had all taken 10 to 15 years ago. They shared the same labs, lecture halls, and cafeteria. That gave them a common language and framework relating to animal health, human health, public health, and most importantly emergency preparedness. And they used it every day. But it took a major international public outcry following the avian pandemic of 2010 to push the necessary political and educational reforms, including a new national certification program and a major infusion of new funds. The result was a radically new interdisciplinary approach for training biomedical health professionals. After the required two-year core curriculum in basic biomedical health sciences, students then went on to specialize in public health, human medicine, veterinary medicine, or health policy, or go into biomedical research. Every month she got an electronic educational package from her college, to keep her fully updated on the latest scientific developments. One surprising benefit of this reform was that her old profession of veterinary medicine was now appreciated and seen at the same level as human cardiology or neurosurgery.

As she stopped by a roadside McDonald's for a fast snack of biologically engineered beef protein, she tried to recall the last decade in which an outbreak of meat-based E. coli or salmonella infection was recorded. The industry-led policing Council for Food and Meat Safety proved far more efficient and rapid than the previous government inspectors. Food companies understood very quickly that sick consumers don't make good customers. As she stood in line, her wrist videophone beeped, and she saw the face of her colleague Sonya in southern Mongolia, who gave her a verbal summary of the monitoring results for all of South Asia for that day. There was nothing abnormal to declare. Sarah sat down and enjoyed the juicy synthetic patty. She thought briefly of her grandmother who by all accounts played gastronomic Russian roulette each

time she ate beef, and appreciated even more the safety of her own world today.

## **C6. GLOBAL WARMING, ECO-CRISIS**

John O'Reilly was finishing his breakfast of vegetable protein eggs and bacon, and reflected briefly on how their texture, taste, and smell was completely indistinguishable from the original chicken eggs and smoked bacon his mother used to prepare 45 years ago. John hadn't seen a live chicken or pig for at least five years. The license to own a pig was more expensive than a luxury car. That is how government chose to reduce the ecological impact of pig farms. In light of recent major climactic catastrophes, government also regulated all other food-producing animals, including cows, chickens, and sheep. This was just as well, because each time a new hurricane struck, or a major region was flooded, millions of dollars were spent not only to relocate people and their families, and almost as much to rescue pets and farm animals. Fortunately, thanks to recent technological advances, this cost had dropped dramatically. It was now possible to pinpoint the location of any living animal in seconds. This had become necessary, because the new hybrid animals, carefully engineered genetically to optimize performance, were very expensive. Animals were no longer used for food or companionship, but largely for the production of transplantation organs and pharmaceutical drugs for humans.

John was preparing to go to his office studio in the loft of his house to make his 10th regional public health announcement in two years. As the senior safety and public health coordinator for the Pacific Coast of what used to be Canada and the US, he was going to alert all the citizens in that region about the latest vaccination procedures against the most recent strain of raccoon influenza. This had become an annual ritual.

He remembered how 25 years ago he had to close his private veterinary clinic, because the cost of owning pets had become prohibitive. The skyrocketing cost of ownership was caused largely by the shift in population that resulted from the growing stress on the country produced by changes in climate and extreme weather events. This population shift created areas of unprecedented high population density that 75 years ago would have only been associated with Third World countries. Under such circumstances, pets were the first to go.

Rising temperatures, increasing urban consumption, and reduced precipitation over the years caused the major aquifers in the West to dry up. The only source of water, which was rigorously rationed by the government, was from solar-powered desalination plants. The growing number of hurricanes, however, occasionally damaged the infrastructure of these plants, which caused even more stress on water availability.

John was now part of an elite group of officials that helped the government make difficult decisions in times of crisis. They all shared an ability to work across many different disciplines affecting biomedical and public health issues. It was his core training in veterinary medicine and comparative physiology and medicine that allowed him to understand the language and priorities of public policy officials, and the science used by public health



officers and physicians. He took an additional certification in emergency preparedness, which became almost essential as the growing number of extreme climatic events disrupted society.

What amazed John was how much of his previous work he could now delegate to young animal wellness professionals (AWPs). Two years after receiving a high school diploma, an AWP was sufficiently trained to operate the critical life form radar at the regional headquarters of the Safety and Public Health Agency. Now they could track in real time where cattle, wildlife animals, and other species were located, monitor their vital signs, and track any contagious diseases the moment they occurred. This was possible through the combination of the powerful radar detection system and the widespread implantation in every living thing of multi-band RF-ID tags that tracked vital signs of each animal.

As John prepared to go “on air,” he glanced at the news headlines, which announced the inauguration of the New Orleans Memorial—a tall concrete pillar over what used to be one of America’s most colorful cities, now well under 20 meters of water, after three decades of continuous rising waters and flooding.

### **7. THE NORMAN ROCKWELL VETERINARIAN**

Dr. Bill Jones was the last one in the veterinary clinic. His four other partners had already left to their families for dinner, and there were only two out of the 15 animal technicians remaining, to stay overnight in the clinic and care for the 72 surgery patients. Before he shut off the indoor environment system that controlled the light, computers, temperature, humidity, and indoor air quality in the office, he glanced at the Norman Rockwell poster of a boy with his dog waiting in a vet clinic, and reflected on his current business. Yes, there were also distressed patients in the waiting room today, but instead of being 10-year-old boys, they were more like octogenarian residents of the adjoining Sunshine Community for geriatrics. But their anxiety and concern over their pets was no less intense than that of the boy in the poster. He recalled the lessons of his mentor, Dr. Foss, who repeated, “You heal the animal and you heal the owner at the same time.” But it took all his hard-earned training in psychology and counseling he received at the School for Advanced Pet Management to help the 92-year-old Mrs. Smith earlier today, to deal with the death of her canoodle, the new genetically engineered dog breed for senior citizens.

He recalled fondly his two years at Dog Chow College, one of the new private veterinary schools created by the largest supplier of dog and animal feed. When they promised they provided training for life, he now realized they were not kidding. Every day, he found himself surrounded with Dog Chow products, medications, bandages, surgery tools and equipment, and specialty foods. He even had access to the Dog Chow central database of veterinary clinical data. With a touch of a screen, he could instantly call up years of veterinary knowledge and clinical experience and a real-time network of specialists across the world, and offer solid advice and diagnosis to his client.

But he had no reason to complain. The income generated from the practice for him and his four partners allowed

them a very comfortable lifestyle in one of the nicer neighborhoods. He was especially proud of his recent election to the municipal school board. He was already planning for the grade 3 visit to his hospital, and would talk to them about the rewards of his profession.

This was not always so. He remembered the major dog meningitis pandemic 10 years ago with a shudder. The new Department of Public Wellness had implemented emergency strategies to eradicate an outbreak of dog meningitis, a deadly infectious disease that was easily transmissible to humans. They announced the eradication program without consulting the veterinary community. There were only 350 human deaths in the North America, but countless dogs were euthanized, creating havoc among the senior population, the most emotionally vulnerable segment of the country. Despite countless e-mails and telephone calls, he was unable to change Washington’s edict that eliminated one quarter of his dog patients. He spent the next two years counseling the bereaved owners and helping them find replacement pets.

Part of that response was due to the major debate within the Animal Wellness Professional Association, who believed strongly in staying focused on small animals, which at the time was the major area of growth. That bitter debate led to a number of members leaving the profession. It also almost completely eliminated funding from federal and state agricultural departments, who saw no reason to fund education in small animal medicine and had no interest in it. But the most damaging consequence of this watershed decision was that his noble profession became a middle-upper-class profession, offering services to the well-to-do. It effectively locked out entire segments of the population, who found little or nothing in common with that approach.

As he was about to shut the door to the clinic, he glanced at Indira, the new intern, who came from an established business family in India. She was here for a six-month certification apprenticeship. She had been here only for two days, but Bill knew her well, having participated in numerous online video training sessions with her class in Bangalore. He was amused by her comment, as she expertly handled a particularly anxious dog. “I learned all my hands-on skills on the new holographic-robotics animal model, but I always imagined they smelled differently. It’s actually quite nice.” The apprenticeship, together with the distance e-learning she took in India over the previous year and half, would give her a ticket anywhere in the world to practice as an animal technician.

He walked toward his fuel-cell-powered and environmentally clean BMW. As the doors opened automatically and the autopilot screen lit up, he leaned back, and said, “Take me home.”

### **8. GLOBALIZED “GOOGLE VETS”**

Ravi Ramanadra was sitting at his desk in Bangalore, India, looking at the 3D holographic screen of his remote clinical examiner. With the help of his multi-sensory gloves, he was exploring in real time the thoracic cavity of a sick cow in Argentina. He was talking in Spanish to the gaucho who brought the cow to the Automated Remote Veterinary Booth (ARVB) on his farm in the remote Pampas. For the gaucho,

it was a matter of bringing the cow from the field to the barn, where the ARVB was located, and served a herd of 4,000 head. For Ravi, it was the third remote call that morning that he fielded without leaving his desk.

Like his grandfather who worked as a software developer from his own home with clients all over the world, and his father who worked for one of the largest Global call-centers based in his native Bangalore, Ravi had an knack for instantly connecting and empathizing with clients from an entirely different culture thousands of miles away. He worked for a large multinational corporation. His employer was Global Vets & Animal Wellness (GVAW), which provided universal care for animals across the world, through a highly successful technology network of remote veterinary booths, the ARVBs, which were managed and maintained by franchisers across the world. The company had developed a unique suite of packages and tools for treating almost any animal condition. In addition to the Surgery by Wire package, the company also had an Emotional Support program, the latest psycho-social counseling software package, which provided a real-time read-out of a pet owner's level of attachment and emotional stress related to his or her pet, and provided instant culturally appropriate language and on-the-spot remote counseling to reduce that stress. And in urban centers, GVAW deployed a small pet version of the ARVB—the Animal Wellness Booth—that requires no veterinary attendant, except as a third level of emergency interventions.

What was less pleasant were the very strict security measures GVAW had implemented to protect the proprietary knowledge-management software. The software had been developed to access a powerful network of specialists across the globe with the latest in treatment and wellness expertise. Ravi noted two outside attempts to crack his password and identity last month alone.

Ravi liked working from the comfort of his house, and enjoyed the incredible variety that GVAW provided. That week alone, he treated remotely an elephant from Thailand with a fractured kneecap, a water buffalo from Kenya, and now the cow from Argentina. Those were the interesting cases. The bulk of the patients who appeared on the screen

were dogs, cats, and the new crossbreed of domestic companion pets for seniors with varying disabilities.

Training in languages (Ravi spoke seven fluently) was part of the vet training he took five years ago at the Singapore International Institute for Animal Health. Languages were essential at SIIAH, since his teachers came from across the globe, connected using the now standard virtual reality terminals. These had been donated by GVAW, and they made remote diagnostics and treatment so routine. He read a recent statistic that showed the number of professionals teaching veterinary health today was a third of what it was 25 years ago, yet the number of students who completed the two-year curriculum, which enjoyed a global certification, was double what it was then. Some of his fellow students worked for the international teams that GVAW deployed to such places as the Brazilian Cattle Association, which had the largest cattle herds in the world. These teams advised the national Departments of Food Production on best practices for cattle wellness. His other roommate from Canada worked for the World Animal and Human Wellness Organization, the new global public health agency.

As he made his internal examinations with the tactile sensors, he simultaneously collected tissue samples for analysis of chemicals, pathogens, and physiological activity. He also noted the DNA localization tag that fixed the cow's origin to a herd near Mendoza. Quickly, he zeroed in on a tumor that was not part of the normal anatomical features of the animal. A click on the surgical program on his screen triggered an automatic sequence of events, perfectly customized and adjusted to this particular animal: local desensitization, excision of the tumor, laser closure of the wound, and closure of the cavity with minimal scarring. The procedure took less than 17 minutes. He advised the gaucho that the cow would be wobbly for the next 12 hours, and to leave her in the stall, with a GVAW recovery diet. Twenty-five years ago, it would have taken three to four days before a veterinarian could fly to a farm, and up to a week or more to perform surgery. As he processed the electronic payment from the Argentinean client, he calculated that it had taken less than 35 minutes from the time the cow appeared in the ARVB to the time it walked away.

# Appendix D: Summary of Individual Remarks by Foresight Workshop Participants at Plenary Sessions

Workshop participants were invited to comment on two challenge questions after they had spent about 1½ days working in teams on the future scenarios.

1. During your team's discussion on a scenario, the most illuminating new idea/concept you heard was \_\_\_\_\_.
2. On the basis of your experience in this workshop, what is your major personal conclusion regarding the strategic direction for academic veterinary medicine?

A total of 175 individual remarks were recorded from 80 participants at the two workshops.

The individual remarks were studied in an effort to identify general topics. Eight topics and several more specific sub-topics emerged. Many remarks were relevant to more than one topic or sub-topic, and they were listed wherever appropriate. The remarks were sorted and listed under each topic or sub-topic heading and analyzed for identification of common ideas, suggestions, or themes. The ideas, suggestions, or themes are summarized below. The number of remarks pertaining to a topic/subtopic is noted and provides an indication of the relative importance associated with each topic or sub-topic as expressed by workshop participants.

## 1. CURRICULUM (76 REMARKS)

### Core Curriculum, Traditional Curriculum, Clinical Practice Pathway (28 remarks)

- It is critical that today's core curriculum and emphasis on whole animal biology be retained. Traditional pathways leading to clinical practice careers are successful, support the largest segment of the profession, account for the majority of those in the applicant pool, and should remain the predominant focus for curricular development and planning today. Nevertheless, today's employers of new graduates find deficiencies or weaknesses in graduates. Current programs need strengthening to better prepare graduates in communications, business, and scientific skills.
- Faculty feel that breadth defeats depth in the traditional clinical curricular pathways because students are expected to have exposure to all species, and that may be a limitation created by requirements for licensure. Licensure requirements are a limitation to clinical curricular development such as allowing more narrow focus and greater depth.

- One need is to improve the clinical pathways for more exposure and learning experiences in primary care cases for entry-level veterinary medicine. Teaching primary care medicine in teaching hospitals, which are increasingly focused on tertiary referral cases, is a problem in that it may not prepare graduates for primary care medicine.
- Consideration should be given to setting a predetermined number of seats for the clinical pathways.
- If traditional clinical curricular pathways are to be revised, educators are encouraged to draw upon the expertise and advice of practitioners.
- Suggested additions to the curriculum that are important to the clinical pathways as well as new pathways include ecosystem health (animals affected by global warming); crisis response to zoonotic outbreak and risk assessment; development of leadership skills, as well as social, economic, and business skills; and technology and scientific advancements (genomics, nanotechnology, and informatics).

### New Curricula to Parallel or Add to the Traditional Curriculum (31 remarks)

- New curricular pathways to be developed in addition to the traditional clinical pathways are: myriad activities related to food supply veterinary medicine; public health; comparative medicine; ecosystem/wildlife health; and biomedical research. The last was emphasized in several remarks.
- The core in the new pathways should be the same as in traditional clinical pathways: whole animal biology.
- New pathways will require strategic alliances to assist in providing hands-on training analogous to that provided in the traditional clinical pathways in teaching hospitals, for example, agencies, or institutions such as local public health offices, animal health product companies, state wildlife agencies, and food industries. As curricula are developed, these stakeholders should be included in the planning.
- Recent experiences in colleges where public health educational opportunities have been developed show that current student populations are attracted to new options.

- Enrollment should be managed by setting a predetermined number of seats for each pathway offered in the college.
- Given a rise in the number of curricular pathways, simultaneous consideration should be given to training opportunities for veterinarians wishing to change career paths.

#### **Diversity, Enrollment, Pedagogy (11 remarks)**

- Expanding the options in curriculum beyond the traditional clinical pathways may enhance diversity. A selection of pathways will allow greater depth in learning experiences to occur in all pathways. Enrollment, based on predetermined numbers of seats, may change the paradigm whereby the number of seats available in physical classrooms limits total enrollment.
- Sharing of expertise among institutions through use of virtual or online courses would further remove enrollment decisions from space availability and reduce instructional costs. Several colleges utilizing the virtual classroom systems would share salaries of instructors for certain disciplines.
- More use of private practices through partnerships to assist with clinical instruction is encouraged.
- Educators are encouraged to increase their use of modeling and simulation technology in the classroom. Technology should also be used to combine expertise into a shared database and progress to virtual instruction. These steps may release educational institutions from limiting enrollment to available seats in a traditional classroom.

#### **Leadership Training in the Professional Curriculum (6 remarks)**

- Leadership training must become part of the curriculum. Educators should be proactive in providing students with experiences calculated to provide leadership capabilities and skills.

## **2. ALLIANCES, PARTNERSHIPS, INTEGRATION OF INSTITUTIONS (28 REMARKS)**

#### **Among Associations within the Veterinary Profession (12 remarks)**

- There is a call for greater interaction among veterinary associations (specialty colleges, state associations, and industrial or corporate groups). Interactive technology may help establish these networks. Regular sharing of job opportunities, human resource shortages, collaboration, and marketing of the profession to society were envisioned.
- State veterinary associations and the AVMA might benefit from conducting Foresight analysis.
- The AVMA and AAVMC are encouraged to make changes that will result in greater perceived value and participation by faculty and all veterinarians. Faculty have limited knowledge about the AAVMC.

#### **With Other Health Professions (9 remarks)**

- Most participants embrace the “One Medicine” concept and recognize a need for greater interaction and collaboration among health professionals. Other health professionals hold the veterinary profession in high esteem when individuals are acquainted and interactive. Ways to enhance such interaction are meetings between deans and leaders of health professions; AAVMC sessions with AAMC, public health academe, and others.

#### **On Campus (7 remarks)**

- Individual faculty frequently engage in teaching, research, or service with faculty of other departments or colleges across campus. These activities have wide-ranging benefits (synergistic research, expanding knowledge about the profession to other students or society in general, etc.), and the practice should be enhanced through greater expectation and recognition from administrators.

## **3. NEED FOR VETERINARY MEDICAL LEADERSHIP (23 REMARKS)**

#### **At Community, State, and National Levels (12 remarks)**

- Greater emphasis on leadership within the profession is desired and should be fostered. With more focus on leadership by veterinarians, opportunities for the profession may expand. Leadership is needed to promote the profession in a wider arena in animal, public, and ecosystem health. AAVMC leadership is necessary for communication, inwardly to faculty and outwardly to other veterinary associations, federal agencies, legislators, etc. AAVMC leadership is necessary for development of new curricular pathways.

#### **Within Academic Institutions (11 remarks)**

- Leadership training is encouraged for faculty. Reward systems as incentives for teamwork should be applied. Leadership and teamwork skills among faculty may result in more rapid change in academia.

## **4. ADMISSIONS, RECRUITMENT, AND MARKETING THE PROFESSION (35 REMARKS)**

#### **Selection Criteria for Admission (9 remarks)**

- Criteria recently adopted or encouraged for use, known under the heading “Skills, Knowledge, Aptitudes, and Attitudes,” are appropriate for the traditional clinical pathways and any new pathways that might be developed. Participants re-emphasized leadership and team skills.
- Background in liberal arts, law, public health, or other disciplines should be given positive consideration.
- If new pathways in addition to the traditional clinical pathways are adopted, work experiences other than clinical experience should be considered in admissions.

### **Diversify the Applicant Pool (12 remarks)**

- Diversity of the applicant pool is thought to be directly related to the public's knowledge about the profession. The public lacks knowledge of the breadth of career opportunities available to veterinarians.
- Proactive ways to diversify the applicant pool are to provide opportunities for early enrollment; seek applicants from political, social, or other sciences; and seek graduates of other health sciences, such as public health.
- Integration of faculty across campus in teaching, research, or service may indirectly result in greater diversity of the applicant pool.
- Giving optional career-oriented curricular pathways and offering a predetermined number of seats per pathway are ways to diversify the applicant pool.

### **Inform Veterinary Students of the Profession's Breadth (4 remarks)**

- Colleges are encouraged to expand their efforts in offering careers courses or exposure of students to the breadth of career opportunities for veterinarians.
- In addition to clinical problem solving, analogous learning opportunities should be adapted in new curricular pathways.

### **Inform the Public of the Profession's Breadth (10 remarks)**

- The broad role of veterinarians in society is information that should be made known across college campuses, among the health professions, and throughout the general public. This effort should be a major campaign implemented at local, state, national, and international levels by the profession.
- An effort is needed to inform federal agencies about the qualifications and training of veterinarians. Attention should be directed to those responsible for hiring in jobs for which veterinarians are qualified. In addition, federal agencies need to revamp the pay scale for individuals holding the DVM or equivalent degree.

### **5. LICENSURE (14 REMARKS)**

- Limited licensure would allow for expanded educational opportunities, augment development of new curricular pathways, change the focus in admissions requirements, augment online education, and diversify the profession. New curricular pathways with flexible or modular elements offered by a coalition of institutions will require flexible licensure. As licensure is a state/provincial responsibility, the discussion on this issue must be engaged beyond academia.

- Multiple curricular pathways and limited licensure will require greater attention to post-DVM training opportunities characterized, not by advanced degrees, but by opportunities to shift career paths.
- Graduates of new curricular pathways and the traditional clinical pathways that become more focused and with greater depth in learning experiences will result in graduates more "job-ready" within a four-year period.

### **6. ACCREDITATION, STANDARDS (6 REMARKS)**

- Participants familiar with current accreditation standards and process believe the system is sufficiently flexible to accommodate changes proposed in the workshops. New standards for new curricular pathways could be developed. One participant from a new school noted that a companion animal pathway may not be offered and expressed concern that problems may arise in gaining accreditation.
- State veterinary associations should be brought into the process for and discussion of development of new standards. State and regional interests in what an academic institution offers must be considered.

### **7. NEED FOR VETERINARIANS TO PARTICIPATE IN POLICY FORMATION (10 REMARKS)**

- Veterinarians must increase their involvement in development of policy at local, state, federal, and international levels. The AAVMC and AVMA should raise the expectation for and demonstrate this involvement. Academic institutions need to teach policy development as a core curricular element.
- The profession should identify and support political candidates who understand veterinary medicine.

### **8. COMMENTS ABOUT FUNDING (10 REMARKS)**

- Federal funding in support of veterinary medical education, research, and outreach will be enhanced through constant engagement by members of the profession with legislators, federal agencies, and related stakeholders. Success in acquisition of federal funds for one bill or another should not be followed by an abandoned effort.
- Veterinarians involved with development of policy will indirectly influence funding in a positive way.
- "Check-off" systems for veterinary services are a means to accumulate funds for veterinary education.
- Reduced costs in education could be appreciated through shared faculty expertise using virtual classroom technology between veterinary colleges and through interdisciplinary arrangements on campuses.

# Appendix E: AAVMC Foresight Project Core Team

## AAVMC STEERING COMMITTEE

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# Appendix F: Study Participants

## SCOPING MEETING—ATLANTA, GEORGIA

### Participants

Sheila W. Allen	University of Georgia
Michael J. Blackwell	University of Tennessee
Conrad G. Brunk	University of Victoria
Lawrence E. Heider	AAVMC
Edward A. Hoover	Colorado State University
William D. Hueston	University of Minnesota
Lonnie J. King	Michigan State University
Deborah T. Kochevar	Texas A&M University
Eve Lloyd Thompson	Bernice Barbour Foundation, Inc.
Bennie I. Osburn	University of California, Davis
Keith W. Prasse	AAVMC
Willie M. Reed	Michigan State University
Michael C. Robach	Cargill Ltd.
Raymond S. Roy	AAVMC
Stephan L. Singleton	University of Georgia

### Observer

Gary Vroegindewey	US Army Veterinary Service
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## WORKSHOP NO. 1—FORT COLLINS, COLORADO

### Participants

L. Garry Adams	College of Veterinary Medicine & Biomedical Sciences, Texas A&M University
Claire Andreasen	Iowa State University of Science and Technology
Michael Andrews	Private practice
David Bristol	NCSU
Theresa Bernardo	Michigan State University
Brian Cassell	Dynamic Veterinary Concepts, LLC
Michael Chaddock	AAVMC
Cyril Clarke	Center for Veterinary Health Sciences, Oklahoma State University
Gary Cockerell	Cockerell Alliances

Alastair Cribb	University of Calgary
Yzoly Criim	Companion animal practice
Jim Cullor	School of Veterinary Medicine, University of California, Davis
Russ Daly	Cooperative Extension Service, South Dakota State University, Brookings
Richard Dierks	AAVMC
Paul Gibbs	Pathobiology, College of Veterinary Medicine, Institute of Food and Agricultural Sciences, University of Florida
Kendra Flood	Colorado State University
James Fox	MIT
Carmen Fuentealba	Western University
Lawrence E. Heider	AAVMC
Ralph Johnson	Colorado Veterinary Medical Association
James Lloyd	College of Veterinary Medicine, Michigan State University, East Lansing
Catherine McClelland	Hill's Pet Nutrition Sales, Inc.
Terry McElwain	Diplomate, American College of Veterinary Pathologists, Washington State University
Bennie I. Osburn	University of California, Davis
Lance Perryman	Colorado State University, Fort Collins
Keith Prasse	AAVMC
Al Rebar	Purdue University
Robert D. Rohde	Dumb Friends League
Glenn Songer	Department of Veterinary Science and Microbiology, University of Arizona, Tucson
Sharon Stevenson	Ohapi Venture Capital
John Tegzes	Western University
Mark Titus	Newport Labs
H. Fred Troutt	University of Illinois—Urbana-Champaign
Chris Zink	Molecular & Comparative Pathobiology, Johns Hopkins Medicine

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**Observers**

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Bonnie Buntain	USDA Food Safety & Inspection Service
Franziska Grieder	National Institutes of Health
Marcus Kehrl	National Animal Disease Center, Agriculture Research Service, USDA

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**WORKSHOP NO. 2—KNOXVILLE, TENNESSEE**

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**Participants**

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Donna W. Angarano	College of Veterinary Medicine, Auburn University
Larry Barrett	California Department of Health Services
Gregg BeVier	AgGlobalVision
Pete Bill	Purdue University
Marilyn J. Brown	Charles River Laboratories
Rene A. Carlson	Animal Hospital of Chetec
Jim Coffman	Kansas State University
Thomas (Leo) Cropper	Battelle (The Business of Innovation)
Larry Dee	World Small Animal Veterinary Association
Barbara C. Diffay	College of Veterinary Medicine, Nursing & Allied Health, Tuskegee University
Dianne Dunning	College of Veterinary Medicine, North Carolina State University
Ray Glick	Banfield (The Pet Hospital)
John R. Glisson	Department of Population Health, The University of Georgia
Eric Gonder	Goldsboro Milling Company
Lisa Greenhill	AAVMC
Richard Halliwell	University of Edinburgh
Kurt Hankenson	University of Pennsylvania Veterinary College
James F. Hart	School of Public Health, University of Minnesota
Lawrence E. Heider	AAVMC
Joan Hendricks	Pennsylvania University
Lizette Hardie	NCSU
Calvin M. Johnson	Auburn University
Laura H. Kahn	Woodrow Wilson School of Public & International Affairs, Princeton University

Alan M. Kelly	School of Veterinary Medicine, University of Pennsylvania
Andrew T. Maccabe	AAVMC
Peter L. Nara	Biological Mimetics, Inc.
Phillip D. Nelson	College of Veterinary Medicine, Western University
John R. Pascoe	School of Veterinary Medicine, University of California, Davis
Keith Prasse	AAVMC
Don Reynolds	College of Veterinary Medicine, Iowa state University
John E. Roane, Jr.	AAVMC
Bill Rood	Rood & Riddle Equine Hospital
Andrew N. Rowan	The Humane Society of the United States
Howard G. Rush	University of Michigan Medical School
Kathleen Salisbury	Department of Veterinary Clinical Sciences, Purdue University
Peggy L. Schmidt	College of Veterinary Medicine, Western University
Leonard F. Seda	Private Veterinary Practice
Charlie Short	Cornell
Don Simmons	AVMA
Erica Stieve	University of Tennessee
Berhanu Tameru	Tuskegee University
Donal A. Walsh	AAVMC (Editor of <i>JVME</i> )

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**Observers**

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Andrea (Andy) M. Morgan	USDA, Animal & Plant Health Inspection Service (APHIS)
Gregory Parham	USDA, APHIS

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**SYNTHESIS MEETING—SACRAMENTO, CALIFORNIA**

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**Participants**

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Roberto Alva	Merial Pharmaceutical & Biological R&D
Gregg Bell	School of Veterinary Medicine, University of California, Davis
Michael Blackwell	University of Tennessee
Conrad Brunk	University of Victoria
Larry Heider	AAVMC
Edward Hoover	Retrovirus & Prion Research Laboratory, Colorado State University



Lonnie King                   Centers for Disease Control and  
Prevention

Deborah Kochevar           Texas A&M University/Tufts University

Joe Kornegay                College of Veterinary Medicine,  
University of Missouri, Columbia

Eve Lloyd Thompson       Bernice Barbour Foundation, Inc.

James Nave                  Private practice

Lance Perryman             College of Veterinary Medicine and  
Biomedical Sciences, Colorado State  
University

Keith Prasse                 AAVMC

Stephan Singleton         Center for Animal Health and Food  
Safety, University of Minnesota

Raymond Roy                Faculté de médecine  
vétérinaire, Université de Montréal

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**Observer**

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Gary Vroegindewey                               US Army Veterinary Service

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