Free Executive Summary

Animal Health at the Crossroads: Preventing, Detecting, and Diagnosing Animal Diseases

Committee on Assessing the Nation’s Framework for Addressing Animal Diseases, National Research Council


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The confirmed case of "mad cow" disease (BSE) in June 2005 illustrates the economic impact of disease outbreaks, as additional countries closed their markets to U.S. beef and beef products. Emerging diseases also threaten public health—11 out of 12 of the major global disease outbreaks over the last decade were from zoonotic agents (that spread from animals to humans).

Animal Health at the Crossroads: Preventing, Detecting, and Diagnosing Animal Diseases finds that, in general, the U.S. animal health framework has been slow to take advantage of state-of-the-art technologies being used now to protect public health; better diagnostic tests for identifying all animal diseases should be made a priority. The report also recommends that the nation establish a high-level, authoritative, and accountable coordinating mechanism to engage and enhance partnerships among local, state, and federal agencies, and the private sector.

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Summary

SYNOPSIS

The national framework to safeguard animal health is of paramount importance to the U.S. economy, public health, and food supply. To strengthen the existing framework, the nation should establish a high-level, authoritative mechanism to coordinate interactions between the private sector and local, state, and federal agencies. New tools for detection, diagnosis, and risk analysis need to be developed now, and the capacity of the existing animal health laboratory network should be expanded for both routine and emergency diagnostic uses. Integrative animal health research programs, in which veterinary and medical scientists can work as collaborators, should be established. Colleges of veterinary medicine must lead an effort to develop a national animal health education plan to educate and train individuals from all sectors (from animal handlers to pathologists) in disease prevention and early detection and to recruit veterinary students into careers in public health, food systems, biomedical research, diagnostic laboratory investigation, pathology, epidemiology, ecosystem health, and food-animal practice. The United States must address the importation and health of exotic and wild-caught animals and commit itself to shared leadership roles with other countries and international organizations that address animal disease agents. Finally, a collective effort should be made to raise the level of public awareness about the importance of animal health and of the national investment in the framework to safeguard animal health.
BACKGROUND

Animal health has broad implications, ranging from the health of individual animals and the well-being of human communities to issues of global security. Many people would be surprised by the assertion that our nation’s highest priorities must include animal health, yet we must recognize and act on this reality to ensure a safe and healthy future. Among other things, animal diseases critically affect the adequacy of the food supply for a growing world population, and they have huge implications for global trade and commerce. Moreover, many animal disease agents are zoonotic—meaning that they are transmittable to humans—so they have dramatic implications for human health and safety, and for animal disease prevention. Animal disease prevention and control is crucial to improving public health on a global scale. In addition, in an era of growing concern about the threat of terrorism, the potential impact of the intentional use of animal disease agents to cause morbidity and mortality, as well as economic damage, is enormous.

The U.S. animal health framework includes many federal, state, and local agencies that generally have differing mandates of law and numerous other public and private entities and international organizations, each with its own goals and objectives, each responsible for maintaining animal health. In the past, this framework has been reasonably effective in responding to a range of demands and challenges. In recent years, however, animal health has been challenged in a manner not previously experienced.

Today animal health is at a crossroads. The risk of disease is coming from many directions, including the globalization of commerce, the restructuring and consolidation of global food and agriculture productions into larger commercial units, the interactions of humans and companion animals, human incursions into wildlife habitats, and the threat of bioterrorism. The impacts of these sources of risk are evident in recent disease events (Box S-1).

Given the changing nature of the risks with which the framework must cope, it is unlikely that the current philosophy on how to protect animal health will be adequate in the future. The risks of animal disease must be dealt with not only in terms of protecting individual species of animals from specific pathogens, but also in a broader context that includes anticipating the emergence and spread of disease on local and global scales and recognizing the relationships of animal disease to human health and the environment. To address animal disease in that context, the animal health framework will have to be more flexible and inclusive of expertise available from research, medical, and public health communities, and from the fields of environmental sciences and public policy, among others. To respond comprehensively to new threats, the responsi-
BOX S-1
Impacts from Recent Disease Events

• In 2003, severe acute respiratory syndrome (SARS) sent a global shock wave, affecting countries with even few cases, such as the United States. Although SARS infected only 8,000 people globally, the disease spread to 30 countries and its effect on the global economy totaled $8 billion.

• The United Kingdom’s economy has not yet recovered from a foot-and-mouth disease (FMD) outbreak in 2001, which also reverberated around the world, affecting both agricultural and nonagricultural interests (such as rural businesses and tourism/recreational use of the countryside).

• A single case of mad cow disease (bovine spongiform encephalopathy or BSE) in Washington State on December 23, 2003, had an immediate market impact and severe, sustained economic losses due to trade restrictions on U.S. cattle and their products. The infected animal was discovered as part of the government’s policy to routinely test downer cattle for BSE, which has been linked to a new variant of Creutzfeldt-Jakob disease, a fatal neurological illness in humans. In June 2005, a second case of BSE was confirmed in the United States.

• In 2004, a new strain of highly pathogenic avian influenza (AI) spread through Southeast Asia, resulting in loss of more than 100 million birds through mortality and control measures and dozens of human cases, highlighting the unpredictable and potentially catastrophic nature of an emerging zoonotic disease. This new influenza strain was transmitted from birds to people, raising concern that it might be capable of evolving into the next pandemic influenza strain.

• In 1999, West Nile virus (WNV), an arbovirus similar to St. Louis encephalitis virus, emerged for the first time in the Western Hemisphere in New York from an unknown source. Over the next five years it swept across the continental United States, Canada, Mexico, Central America, and several Caribbean islands, carried by mosquito vectors infecting wild birds. In the United States in 2004, the virus was detected in approximately 2,250 humans (40 states), 1,250 horses (36 states), nearly 7,000 wild birds, mostly corvids (45 states), and in much smaller numbers in a few other animal species. While these numbers are substantially below those that occurred in the first wave of infection, WNV bodes to become endemic in wild birds and an ongoing source of infection transmitted to other species by mosquito vectors.
bilities of the framework’s many actors will need to be clearly defined and their actions better coordinated. Admittedly, the process of transformation is difficult during periods when disease outbreaks consume all attention. However, now is the time to strengthen the structure of the current system and to instigate a change in its culture, so that it will be capable of responding effectively in the future.

This report explores the evolving challenges facing animal health, identifies vulnerabilities and gaps in the animal health framework, and recommends steps needed to fill gaps and improve the effectiveness of the framework.

COMMITEE’S STATEMENT OF TASK

Recent animal and human health events have illustrated that the national system for protecting animal health is now facing a continuum of host-parasite relationships involving public health, wildlife, ecosystems, and food systems, operating in an increasingly complex global context (see Figure S-1). Adapting the current framework to this new reality will be both a major challenge and a national imperative.

In recognition of the changing influences on animal health, the National Academies developed a concept for a three-phase analysis of the U.S. system for dealing with animal diseases and committed institutional funds to launch the first phase of the study. This report, which embodies the first phase of the study, presents an overview of the animal health framework and examines the framework’s overall operation in the prevention, detection, and diagnosis of animal diseases. The proposed second phase of the study (pending supplemental external support) will focus on surveillance and monitoring capabilities, and the proposed third phase will focus on response and recovery from an animal disease epidemic. Although surveillance and monitoring play an important part in prevention, detection, and diagnosis, the second phase of the study, as currently envisioned, will analyze in greater depth the system’s capacity and needs for surveillance and monitoring of animal diseases.

Relative to its respective focus, each phase of the study will: (1) review the state and quality of the current system for dealing with animal disease; (2) identify key opportunities and barriers to successfully preventing and controlling animal diseases; and (3) identify immediate courses of action for those on the front lines.

This first phase of the study did not attempt an in-depth review of the effectiveness of each individual component of the framework or of any specific agency involved in safeguarding animal health—a task well beyond the scope of this effort—but did examine the effectiveness of the
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OVERVIEW OF THE ANIMAL HEALTH FRAMEWORK

The essential components of the animal health framework include the following:

framework as a whole in relation to different animal disease scenarios. In doing so, it sought to identify ways to improve the framework.

Finally, although animals are subject to the same causes of disease as humans—that is, diseases with chemical, physical, microbial, or genetic causes—the study focuses primarily on infectious diseases, as directed by the Statement of Task (see Chapter 1, Box 1-1, for the committee’s Statement of Task). This focus arises from concern about the growing threat posed by the spread of emerging infectious disease associated with the increasing global interconnectedness of domestic animals, wildlife, and humans, and by the possibility of bioterrorism.

FIGURE S-1 Interactions of emerging infectious diseases (EIDs) with a continuum that includes wildlife, domestic animal, and human populations. Few diseases affect exclusively one group, and the complex relations among host populations set the scene for disease emergence. Examples of EIDs that overlap these categories include Lyme disease (wildlife to domestic animals and humans); bovine tuberculosis (between domestic animals and wildlife); *Escherichia coli* O157:H7 (between domestic animals and humans); and Nipah virus and rabies (all three categories). Companion animals are categorized in the domestic animal section of the continuum.
• people on the “front lines” of the animal production unit, animal habitat, or companion animal household (including ranch and farm workers, producers, feeders, breeders, park rangers, companion animal owners, wildlife rehabilitators, and zoo keepers);
• veterinarians and other sources of professional advice and care for health-related issues (such as universities and diagnostic laboratories);
• federal, state, and local animal health and public health agencies (consisting mainly of state departments of agriculture and state diagnostics laboratories within universities and elsewhere in state governments, and numerous bureaus and offices within over 10 federal departments, but primarily within the U.S. Departments of Agriculture, Homeland Security, and Health and Human Services);
• international collaborations among agencies, organizations, and governments (such as the World Organization for Animal Health and the World Health Organization);
• supporting institutions, industries, and organizations (including educators, researchers, and the public health and intelligence communities).

Because of the very large number of actors responsible in some way for safeguarding animal health, it is not surprising that effective coordination is a major challenge. In a retrospective analysis of numerous specific animal disease situations, the committee examined the collective capabilities and limitations of the framework with respect to its effectiveness in the prevention, detection, and diagnosis of animal diseases. Several weaknesses, needs, and gaps were consistently encountered in the framework’s response to a broad spectrum of disease types including exotic Newcastle disease (END), foot-and-mouth disease (FMD), monkeypox, bovine spongiform encephalopathy (BSE), chronic wasting disease (CWD), West Nile virus (WNV), avian influenza (AI), and diseases caused by coronavirus. This examination led the committee to the following conclusions:

• The framework for animal health lacks adequate systems and tools for analyzing and managing risk, and planning for outbreaks.
• Efforts to develop and validate diagnostic assays and advanced vaccines of a recognized pathogen need to occur more rapidly.
• The workforce on the front lines of animal care is not adequately educated and trained to deal with animal disease issues, and there is a shortage of veterinarians in the workforce for animal disease prevention, detection, and diagnosis.
• Greater collaboration between public health and animal health officials can accelerate the detection and diagnosis of animal diseases.
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- The broad capabilities that exist in universities, industry, state entities, veterinary diagnostic laboratories, and other local animal health infrastructure are underutilized.
- The lack of collaboration between the biomedical and veterinary communities is a lost opportunity that impedes the effectiveness of the framework.
- There is a need for state-of-the-art equipment and biocontainment facilities for both research and diagnostics. Federal, state, and private entities responsible for animal health have different authorities, and there are gaps in that authority, particularly in relation to wildlife disease.
- The past success of international collaboration in responding to animal disease demonstrates its importance in addressing animal diseases.

RECOMMENDATIONS FOR STRENGTHENING THE ANIMAL HEALTH FRAMEWORK

Reflecting on the structure of the framework and based on the findings of its analysis of past animal health events, the committee offers the following 11 recommendations as potential opportunities for strengthening the framework’s capabilities in the prevention, detection, and diagnosis of animal diseases.

Coordination of Framework Components

Recommendation 1: The nation should establish a high-level, centralized, authoritative, and accountable coordinating mechanism or focal point for engaging and enhancing partnerships among local, state, and federal agencies and the private sector.

There is a need for a strategic focal point to enhance partnerships and to integrate all stakeholders into a cohesive whole. Many federal agencies are responsible for parts of animal health policy, with significant overlaps in the programmatic functions among them and also between federal agencies and programs directed through states or animal health organizations. On the other hand, there are also gaps in responsibility. Of particular concern is the paucity of federal oversight of the nonlivestock, animal-centered aspects of zoonotic diseases.

While there are several possible models for improved coordination in prevention, detection, and diagnosis, the committee did not recommend options for a specific system-wide mechanism, in part because it has only examined the animal health framework from the partial perspective of prevention, detection, and diagnosis.
Regardless of how a central coordinating mechanism or focal point is implemented, it will need to promote effective communication among various stakeholders and with the public during and outside episodes of animal disease outbreaks. Opportunities for information-sharing between agencies using electronic information systems should be developed. A methodic effort should be made to identify and link key databases and establish protocols for contributing data and generating alerts.

**Technological Tools for Preventing, Detecting, and Diagnosing Animal Diseases**

*Recommendation 2:* Agencies and institutions—including the U.S. Department of Agriculture (USDA) and the Department of Homeland Security (DHS)—responsible for protecting animal industries, wildlife, and associated economies should encourage and support rapid development, validation, and adoption of new technologies and scientific tools for the detection, diagnosis, and prevention of animal diseases and zoonoses.

The current animal health framework has been slow to evaluate, validate, and implement new scientific tools and technologies that could significantly enhance animal disease prevention, detection, and diagnostic capabilities for the United States. Despite a recent surge in activity related to post-September 11 homeland security efforts and associated focused funding, the active review and implementation of advancing technologies has been inadequate to protect and enhance the health of the country’s animal populations and related economic systems. Technological advances—such as immune system modulators, animal-embedded monitoring (chips embedded underneath an animal’s skin to monitor temperature and other physiological indices), and differential vaccines as prevention strategies, as well as a range of rapid, automated, sensitive, and portable sampling and assay systems for early warning and reliable diagnosis—have not been adequately exploited by the current animal health framework. Early biodefense warning systems, such as DHS’ BioWatch or private industry’s gene-based anthrax testing, are designed for rapid detection and identification of key pathogens by sampling air in public environments. These systems have been operating since early 2003 and are meant to assist public health experts in rapidly responding to the intentional release of a biologic agent (DHS, 2004a). Early warning technologies have not yet been adequately evaluated by the animal health infrastructure.
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Scientific Preparedness for Diagnosing Animal Diseases:
Laboratory Capacity and Capability

Recommendation 3: The animal health laboratory network should be expanded and strengthened to ensure sufficient capability and capacity for both routine and emergency diagnostic needs and to ensure a robust linkage of all components (federal, state, university, and commercial laboratories) involved in the diagnosis of animal and zoonotic diseases.

Laboratory diagnosis of animal diseases in the United States involves federal, state, university, and commercial entities. The committee focused its assessment on the condition of publicly funded laboratories and the current operational status of national laboratory networks. Funding and implementation of the pilot National Animal Health Laboratory Network (NAHLN) in June 2002 was an important and beneficial paradigm shift from an exclusive federal system to one with shared state and federal responsibility for foreign animal disease diagnosis. The pilot NAHLN involved 12 state/university diagnostic laboratories approved for disease testing using existing and newly developed assays. The NAHLN is no longer a pilot program and has since been redefined to include all laboratories performing contract work for the USDA on BSE, CWD, scrapie, AI, END, and classical swine fever (CSF). However, the current network lacks surge capacity and is not prepared for disease agents and toxins outside the narrow list of diseases that provided an initial focus for network development (for example, FMD or Rift Valley fever). In addition, implementing this recommendation will require the creation of formal linkages and operational relationships between the NAHLN, state and university veterinary diagnostic laboratories, and the Laboratory Response Network for Bioterrorism (LRN), established by the U.S. Centers for Disease Control and Prevention (CDC) in 1995 to improve the response capabilities of the nation’s public health laboratory infrastructure. It will require development of additional biosafety level 3 (BSL-3) necropsy and laboratory capacity. Population-based diagnostic and detection systems also will need to be developed by diagnostic laboratories in order to provide the broad diagnostic outlook necessary for detection of new and emerging diseases.

Animal Health Research

Recommendation 4: Federal agencies involved in biomedical research (both human and veterinary) should establish a method to jointly fund new, competitive, comprehensive, and integrated animal health research programs; ensure that veterinary and medical scientists can work as collaborators; and enhance research, both domestically and interna-
tionally, on the prevention, detection, and diagnosis of animal and zoonotic disease encompassing both animal and human hosts.

This process might be modeled on the National Institutes of Health (NIH)-administered Interagency Comparative Medicine Research Program, an interagency task force model, or some comparable process that promotes this type of cooperative research agenda.

This recommendation builds on the 2003 Institute of Medicine (IOM) report *Microbial Threats to Health: Emergence, Detection, and Response,* which states: “NIH should develop a comprehensive research agenda for infectious disease prevention and control in collaboration with other federal research institutions and laboratories (e.g., CDC, the U.S. Department of Defense, Department of Energy, the National Science Foundation), academia, and industry” (IOM, 2003). Currently, basic and translational research related to prevention, detection, and diagnosis of animal and zoonotic diseases is being conducted by a complex array of government, academic, and private institutions and there is minimal coordination, if any, in setting priorities to ensure that important research topics are not overlooked and to ensure the most effective use of scarce resources. A forthcoming National Research Council (NRC) report *Critical Needs for Research in Veterinary Science* will contain a more in-depth assessment of national needs for research in animal health.

**Recommendation 5:** To strengthen the animal health and zoonotic disease research infrastructure, the committee recommends that competitive grants be made available to scientists to upgrade equipment for animal disease research and that the nation construct and maintain government and university biosafety level 3 (BSL-3 and BSL-3 Ag)\(^1\) facilities for livestock (including large animals), poultry, and wildlife.

Access to state-of-the-art equipment and technological tools is essential to successfully conduct the research needed to understand, prevent, and control emerging or exotic infectious agents. When a new infectious agent is suspected, efforts must be made to first rapidly define and characterize the agent, under strict biocontainment conditions. At present, few BSL-3 or BSL-3 Ag facilities are available strategically throughout the United States or are equipped and prepared for research on diseases of livestock, poultry, or wildlife, including zoonoses that require BSL-3

\(^1\)Containment facilities are classified as Biosafety Levels 1 through 4, with 4 being the most restrictive. Biosafety level 3 (BSL-3 or BSL-3 Ag) provides the high degree of containment that is needed when studying a variety of organisms with a recognized potential for significant detrimental impact on animal or human health or on natural ecosystems.
biocontainment. Additional BSL-3 facilities are needed for research and surge capacity (in case of outbreaks) for detection, diagnosis, and prevention of many zoonotic and all exotic animal pathogens.

International Interdependence and Collaboration

**Recommendation 6:** The United States should commit resources and develop new shared leadership roles with other countries and international organizations in creating global systems for preventing, detecting, and diagnosing known and emerging diseases, disease agents, and disease threats as they relate to animal and public health.

As the United States and the rest of the world become increasingly interdependent, it is essential to identify animal disease risk factors as they emerge and to focus more attention on the sources and precursors of infections. Taken collectively, the recent experience with SARS, West Nile virus, and monkeypox leads to the inescapable conclusion that globalization, population growth, and expansion of human activity into previously unoccupied habitats has essentially connected the United States to potential zoonotic and nonzoonotic pathogens residing throughout the world. This necessitates coordinated international collaboration efforts directed at identifying potential risks worldwide, including regulatory mechanisms that minimize the threat of introducing emerging infectious agents into the United States or other unaffected countries.

For potential and emerging infectious agents in other countries, assistance from the United States is more ad hoc or piecemeal than strategic and wide-ranging. By adopting a more comprehensive approach to helping countries strengthen their prevention, detection, and diagnostic capabilities, the United States will enhance its own animal health framework and security. Means to accomplish this include transferring technology between nations and providing training opportunities to international students and veterinarians to ensure self-sufficiency and sustainable surveillance. The United States can also encourage and support the enhancement of critical competencies within the national services, which includes active participation in the formulation of international standards and the timely reporting of zoonotic and exotic diseases. The charge to the committee explicitly states that it will “review the U.S. system and approach for dealing with animal diseases,” and the committee regards the international dimension as an extremely critical component of the U.S. animal health framework. With increased globalization and movement of diseases, people, products, pathogens, and vectors, the United States cannot continue to impose a line between domestic and international issues but should instead adopt an animal health system that identifies and responds to animal disease threats without regard to national boundaries.
Importation, Sale, and Transport of Animals

Recommendation 7: Integrated and standardized regulations should be developed and implemented nationally to address the import, sale, movement, and health of exotic, nondomesticated, and wild-caught animals.

Such a policy development needs to include health professionals and laboratory-based analysis because wild-caught and exotic animals may carry pathogens and pose a risk of transmitting disease without demonstrating clinical signs. The monkeypox outbreak of 2003 highlighted a number of weaknesses in the animal health framework for addressing a newly emergent zoonotic disease. In particular, while several federal agencies (including the U.S. Department of Agriculture, U.S. Department of the Interior’s Bureau of Fish and Wildlife Service, and the U.S. Department of Health and Human Services) have roles in preventing, detecting, and diagnosing zoonotic and other diseases transmitted by exotic animals, there is a lack of coordinated federal oversight of the animal-centered aspects of diseases transmitted by exotic animals. Prior to the interim final rule banning the import, sale, or distribution of prairie dogs and some African rodents (responsible for the monkeypox outbreak in 2003), import and movement of exotic animals was largely uncontrolled (and most exotic animal movement is still uncontrolled). Tracking of these animals in the United States is inconsistent and ineffective, and there is a disturbing lack of standardized testing of the health status of exotic animals at the point of origin and in companion animal shops, trade fairs, and other venues. Considering that the emergence of new disease agents occurs most frequently at species interfaces, monkeypox is not likely to be the last zoonotic agent to emerge from an exotic animal in the United States.

Addressing Future Animal Disease Risks

Recommendation 8: The USDA, DHS, Department of Health and Human Services, and state animal and public health agencies and laboratories should improve, expand, and formalize the use of predictive, risk-based tools and models to develop prevention, detection, diagnostic, and biosecurity systems and strategies for indigenous, exotic, and emerging animal diseases.

There has been increased recognition and use of well-structured and scientifically based mathematical, epidemiological, and risk analysis models and tools to define acceptable risks and mitigation strategies that can assist in policy and science-based decision making. Examples include models of the spread of FMD during the U.K. epidemic, and an assessment of the risk of BSE to U.S. agriculture, developed by Harvard
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University’s Center for Risk Analysis for the USDA (Cohen et al., 2003; Haydon et al., 2004). Risk analysis and modeling have been criticized, mainly on the basis of insufficient scientific data or inappropriate assumptions. Therefore, efforts to develop scientific data on disease transmission, effectiveness of control programs, economic evaluation, and quantitative assessment of all factors involved in making policies and regulations should be a priority of the animal health infrastructure, working in collaboration with academia, industry, and global trade partners.

Threats from bioterrorism, emerging diseases, and foreign animal disease introductions add urgency to preventing or minimizing catastrophic consequences to the United States, other nations, and the global economy. Education and training of professionals to assess, manage, and communicate risk of animal disease and improved information available to stakeholders, including producers and the public, are important aspects of effective infrastructure that supports risk-based approaches.

Education and Training

Recommendation 9: Industry, producers, the American Veterinary Medical Association (AVMA), government agencies, and colleges of veterinary medicine should build veterinary capacity through both recruitment and preparation of additional veterinary graduates into careers in public health, food systems, biomedical research, diagnostic laboratory investigation, pathology, epidemiology, ecosystem health, and food animal practice.

There are insufficient graduates to meet the needs in a number of major and distinct fields of veterinary medicine dealing with various species of food-animals, rural practice (mixed domestic animals), ecosystem health (including wildlife disease and conservation biology), public health, the many dimensions of the food system, and biomedical science. In addition, veterinary graduates are not adequately prepared to deal with foreign animal diseases, public health, and ecosystem health, without further postgraduate studies. According to the Association of American Veterinary Medical Colleges (AAVMC), the 28 veterinary colleges in the United States graduate approximately 2,300 veterinarians per year and are currently unable to keep up with societal needs in private or public practice.

There has been a steady decline in the number of rural practitioners and of veterinarians employed in regulatory agencies. The USDA, underserved at present, predicts a shortfall of 584 veterinarians on its staff by 2007. Fifty percent of U.S. Public Health Service veterinarians are currently eligible for retirement.
Too few veterinary students are choosing to specialize in basic biomedical science or pathology, as noted in the recently published NRC report *National Need and Priorities for Veterinarians in Biomedical Research*, which suggests a strategy for recruiting and preparing more veterinarians for careers in laboratory animal medicine, comparative medicine, and comparative pathology (NRC, 2004b). This committee endorses the recommendations of that report.

One strategy for building veterinary capacity is to design and implement training and educational curricula to better address these underserved areas of animal health. The Veterinary Workforce Expansion Act of 2005, which amends the Public Health Service Act, will be a useful first step that establishes a competitive grants program to build capacity in veterinary medical education and expands the workforce of veterinarians engaged in public health practice and biomedical research.

**Recommendation 10:** The USDA, state animal health agencies, the AVMA, and colleges and schools of veterinary medicine and departments of animal science should develop a national animal health education plan focusing on education and training of individuals from all sectors involved in disease prevention and early detection through day-to-day oversight of animals.

Responsibility for implementing the educational plan would fall on those at the local level. Strong and well-functioning front-line detection is provided by animal handlers and personnel working with animals on a day-to-day basis. This backbone for effectively preventing animal disease outbreaks requires education and training to include awareness and recognition of clinical signs, as well as an elementary understanding of disease transmission and prevention. In addition, those with day-to-day oversight of animals need to understand the methods and responsibilities for reporting the signs of foreign and exotic animal diseases. Basic multilingual education and training are necessary for those with such direct oversight of animals, whereas more in-depth education to promote a greater depth and breadth of understanding of transmission and prevention is required for managers and owners.

**Improving Public Awareness of the Economic, Social, and Human Health Effects of Animal Diseases**

**Recommendation 11:** The government, private sector, and professional and industry associations should collectively educate and raise the level of awareness of the general public about the importance of public and private investment to strengthen the animal health framework.
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Increased public awareness is critical in supporting and implementing transformations needed to strengthen the framework against animal disease risks. The lack of cohesive national advocacy for public health issues generally creates a much more difficult environment in which to increase attention and investment in the framework for preventing, detecting, and diagnosing animal diseases.

The recent outbreaks of FMD, SARS, AI, and BSE are all reminders of the threats such diseases pose to the U.S. food supply, global economy, public health, and confidence in the safety of the food supply. The entire food and fiber system—including farm inputs, processing, manufacturing, exporting, and related services—is one of the largest sectors of the U.S. economy and accounts for output of over $2 trillion dollars, generating $1.24 trillion in added value, and 12.3 percent of total gross domestic product in 2001 (USDA, 2003). Nearly 17 percent of all U.S. workers are employed by the food and fiber system (USDA, 2003). Producers, companion animal owners, and others on the front line have a direct personal and private interest in detecting, diagnosing, and preventing animal diseases to avoid losses associated with reduced productivity, animal mortality, or potential effects on personal health and welfare. Although these losses can be significant, adverse social, economic, and human health impacts associated with animal diseases extend beyond producers or household animal owners.

Increased investment in educating the public about animal health will help to reduce disease and transmission; enhance public and animal health; ensure a secure, economical, and viable food supply; and improve trade and competitiveness. These educational efforts should include information about diseases of food-animals, wildlife, and companion animals.
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Suzanne Kennedy Stoskopf, Pylon Research Laboratories

Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations nor did they see the final draft of the report before its release. The review of this report was overseen by Linda Cork, Stanford University, and Mary Jane Osborn, University of Connecticut Health Center. Appointed by the National Research Council, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

This report is dedicated to the memory of Alfonza Atkinson, a member of the Committee on Assessing the Nation’s Framework for Addressing Animal Diseases.
Preface

The committee was charged to assess the country’s framework to support animal health in the context of our rapidly changing world and the contemporary challenges faced by those involved in animal health and diseases. In this report, the first of an intended three-part series, the committee members were asked to focus on the prevention, detection, and diagnosis of animal diseases and the dynamics of these systems as part of the overall animal health framework. It has also set the groundwork for two other studies and subsequent reports that will follow to assess the surveillance and response systems within the framework.

The world of animals—domestic, wildlife, and food-producing—and their health has increased in complexity and importance over the last century. In addition, the challenges and opportunities for animal health that have become especially apparent over the last several decades are unprecedented. Our animal health system is inextricably interwoven into both our national and global economy, as well as numerous societal issues including the public’s health. Animal agriculture, in particular, finds itself in the midst of fundamental change and transforming forces. The scope, scale, and potential implications of the global food-animal system and its associated infrastructure to monitor and support animal health and food safety work is without precedent. In their examination of the animal health framework, with special reference to prevention, detection, and diagnosis, the committee members were struck with the new interdependence of animal health concerns and needs with issues such as public health and medicine, economics, global trade, and national and international security. Virtually all aspects of the current animal health frame-
The committee purposely had a significant human health component, which added greatly to its understanding and appreciation of the convergence of human and animal health and the strong linkage between animal and public health. The contemporary issues of emerging infectious diseases, new zoonoses, bio- and agroterrorism, antimicrobial resistant pathogens, and global health threats reaffirm the importance of the convergence and the consideration of these influences on the future of animal health and its associated framework.

The committee examined other reports and publications, listened to invited speakers, engaged in lengthy discussions, and brought together diverse perspectives and a variety of experts. Through this process and deliberations, a strong consensus developed from the current crossroads that the United States must pursue a very different path; the future of animal health and the prevention, detection, and diagnosis systems will have to be very different from the past. The animal health framework in the United States is ripe for a transformation characterized by improvements in capacity and skills, new strategic partnerships, integration of its work processes and systems, the understanding and adoption of new technologies, and a broader global perspective.

The U.S. animal population and its associated animal health framework represent an exceptional national asset that impacts the lives of people everyday. Yet, the very people whose lives are improved and who benefit from their relationship with animals and their products are progressively less aware, fail to perceive the relevancy, and consequently are seemingly less supportive of the animal health enterprise. This fact will add a significant burden to the needed transformation effort.

The National Academies convened this committee to assess and address the national animal health framework at a very special time in the history of animal health. The committee’s findings and recommendations support the compelling need for significant changes to create a new future. The decisions made today will define this future, not decisions made
tomorrow. The title of the report uses the analogy of a crossroads. This analogy suggests that multiple options and pathways exist to the future; however, the committee and its recommendations support the notion that an entirely new pathway needs to be created that will significantly change both the planners and implementers of the framework, and, most importantly, the ultimate destination.

Lonnie King, Chair
Margaret Hamburg, Vice Chair
Committee on Assessing the Nation’s Framework for Addressing Animal Diseases
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