

IMPACT STUDY: Exploring the Role of the University of Pennsylvania School of Veterinary Medicine

A study by KPMG Peat Marwick concludes that the University of Pennsylvania's School of Veterinary Medicine contributes more than \$1 billion and nearly 2,000 jobs to the Commonwealth's economy.

These are the highlights of the study commissioned by the School as part of its long-range planning program. The study portrays the School as a major contributor to Pennsylvania's and the nation's agricultural and biomedical industries in three major areas:

- **Manpower:** through the training of highly qualified practitioners, specialists and biomedical scientists to meet present and future needs of the agriculture and biomedical industries; and through providing quality continuing education programs for practicing veterinarians.
- **Economic development:** by providing unique programs and outreach from the Center for Animal Health and Productivity; and by delivering highly sophisticated veterinary medical services;
- **Research/technology transfer:** by creating new knowledge through basic and applied biomedical research, including behavioral research, comparative medicine and public health.

KPMG Peat Marwick describes the School as a recognized world leader, not only in veterinary medicine and education, but in the furtherance of biomedical research. Its faculty are in demand as speakers at international conferences and their calibre is further recognized in the large number of endowed professorships at the School.

For more than a century, says the study, the School has led the way in improving the health, productivity, and economics of food-producing animals. It was the first to use tuberculin to control bovine disease; today, researchers are studying Johne's Disease and *Salmonella enteritidis* while others are developing recombinant vaccines against a multitude of animal diseases.

Ongoing research promises future benefits in the fields of biotechnology and aquaculture and in the prevention and treatment of diseases potentially affecting about 80 million Americans and having an estimated market value of \$70 billion annually.

"Such research breakthroughs will contribute to improved human health and prevention of disease," states the study.

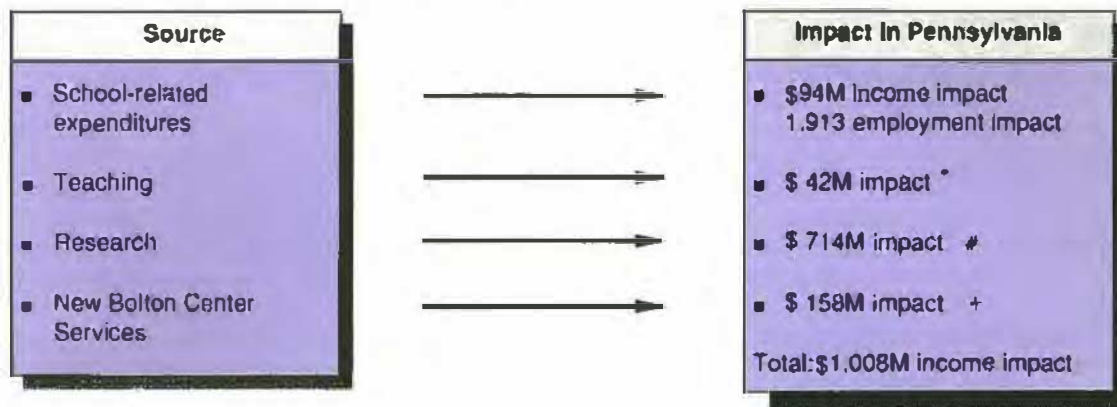
The Commonwealth of Pennsylvania has historically recognized the importance of the Veterinary School to the agricultural industry in the State. It currently appropriates \$15 million to support the teaching, research, diagnostic, and treatment activities of the School. This amounts to a third of the School's current operating budget, proportionately far less than state support to land-grant veterinary schools across the nation which receive up to 50 percent of their operating budgets from their states.

By almost any measure one chooses, the return on the State's investment is enormous. The following is a detailed breakdown of the economic impact of the Veterinary School on the economy of Pennsylvania.

The Veterinary School's Economic Impact on the Commonwealth

Total Impact

The School's impact of more than \$1 billion on the economy of Pennsylvania is both direct and indirect. The direct impact is the total dollar value of school-related expenditures in specific geographic areas; the indirect impact is the additional spending and jobs created by the recycling of those original school-related expenditures in the economy.

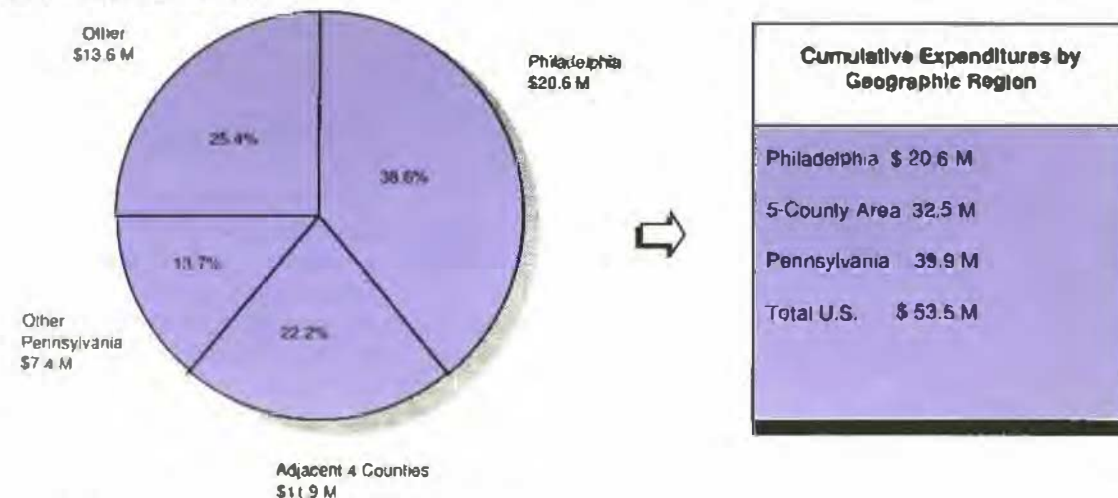


* Increased earning power of 1,356 VMDs in Pennsylvania.

Annual loss of productivity due to diseases in food producing animals. (PDA Statistical Service; KPMG Analysis)

+ Value of food animals and horses treated and returned to production and performance. (PDA Statistical Service; TOBA; KPMG Analysis)

Direct Impact: The direct expenditures shown here are used to determine the income and employment impact of the School.



Multiplier Effect: The total economic impact of the School-related expenditures is \$93.6 million in Pennsylvania.

School - Related Expenditures	Income Multiplier	Total Income Impact
\$20.6 million in Philadelphia	Philadelphia: 1.7189	\$35.5 million in Philadelphia
\$32.5 million in 5-County Area	5-County Area: 2.2271	\$72.4 million in 5-County Area
\$39.9 million in Pennsylvania	Pennsylvania: 2.3491	\$93.6 million in Pennsylvania
\$53.5 million in Total United States	United States: 3.2591	\$174.2 million in Total United States
	Employment Multiplier*	Total Employment Impact
	Philadelphia: 25.2	520.2 jobs in Philadelphia
	5-County Area: 44.3	1400.3 jobs in 5-County Area
	Pennsylvania: 48.0	1913.2 jobs in Pennsylvania
	United States: 60.3	3223.8 jobs in Total United States

Technology Transfer Impact: The School's teaching, research and service activities have a potential economic impact of \$914 million in Pennsylvania.

Activities	Sample Potential Products	Sample Potential Impacts
Teaching	Practitioners Researchers	Enhanced income and expenditures (\$104 million in US; \$42 million in PA)
Research	Food production improvements Veterinary products Human health care products	Food animal health and productivity (\$18 billion potential in US; \$714 million potential in PA) New veterinary products (\$14 million potential in US)
Service	Treatment of valuable animals Food production efficiency improvements	New Bolton Center services (\$239 million in US; \$158 million in PA)

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The Use of Animal Models Assists Researchers in Today's Scientific Discovery

The use of animal models in biomedical research is critical for continued progress to combat disease and to discover new and better treatments for existing illness and conditions. The vast majority of scientists and researchers involved in medical exploration agree that without the use of animal models, major medical advances would not have been achieved nor would current research techniques be available.

To solve health problems, researchers must have scientific data that is relevant to the human condition. Data from human experiments is the most scientifically relative. But such experimentation, in many cases, is ethically unacceptable. Few people would offer themselves or a family member as the first subject of research to understand and cure diseases such as AIDS or Alzheimer's. The U.S.

Government requires that most safety testing be designed and based on results of animal experimentation and a knowledge of the history of the disease or condition under study. After humans, animals offer the most accurate means to assess human biological reactions and responses.

Nonanimal research models are used in research labs across the country whenever possible. Biological models such as cell and tissue cultures, and nonbiological techniques such as mathematical and computer modeling, are used where appropriate. However, since these methods cannot mimic all the complicated interactions that occur in humans or animals, animal testing is still necessary. Knowledge gained from animal research has helped scientists develop many adjunct techniques that are reducing the numbers of animals required.

The Role of Animals in Current Research and Testing

Biomedical research with animals has four major goals:

- To provide biological knowledge upon which disease prevention can be based;
- To provide models for the study of naturally occurring diseases of humans and animals;
- To test potential therapies, diagnostic and surgical procedures, and medical devices;
- To study the safety and efficacy of new drugs or to determine the potential toxicity of chemicals to which animals will be exposed.

Researchers must understand the biology and physiology of higher organisms before they can make advances in the treatment and prevention of disease. Animal models provide information on the mechanisms of disease and an organism's own defensive response. Scientists study animal models for clues as to how the disease is transmitted and how genetic susceptibility and other factors may predispose an individual to disease. In the case of infectious disease, scientists attempt to isolate the disease-causing agent in the affected animals as the first step toward development of a vaccine.

Data from animal studies is essential before new therapeutic techniques and surgical procedures can be tested on patients. Researchers must use animal models to develop and refine techniques to determine if the techniques will achieve their purpose without risking harm to the patient. Animals are also essential to measure a drug's beneficial or harmful effects on organs and tissue. Moreover, data documenting efficacy and safety is required by the Food and Drug Administration (FDA) before a new drug is approved for testing in clinical trials on humans. Such testing remains the best predictor of adverse risks such as cancer, reproductive disorders and birth defects.

Two of the most controversial tests are the Lethal Dose 50 (LD50) and Draize tests. The LD50 test provides data on how toxic a substance is by determining the dose needed to kill 50 percent of a test group of rodents. The classical LD50 test using large numbers of animals is rarely used today. The maximum tolerable dose is important information for some cancer chemotherapeutic agents where the clinically effective dose is near the lethal dose. The doses that animals tolerate on an acute basis provide information for risk assessment and also determine doses for further studies. Many toxicologists believe that fewer animals can be used to achieve sufficient data, and work is being done to develop nonanimal methods.

There are two Draize tests: one for the eye and one for the skin. The Draize eye irritancy test measures how safe a substance is to the eye by putting drops of a substance on rabbits' eyes. While modifications of this test and alternatives are being explored, many scientists and the FDA believe that this is still one of the best predictors of the effects a chemical would have on the human eye. The skin test is performed in a similar fashion, by exposing a chemical substance to an animal's skin to measure possible irritancy.

Duplication and Validation of Research

Both government and private research institutions practice stringent review processes when approving research projects because of concern for the number of animals used and because of the cost of research. Experts review research proposals to measure the importance of a project, its scientific merit, the competence and the appropriateness of research models.

NIH, the major single source of funding for U.S. biomedical research, requires each grant application to include a bibliography of all relevant scientific literature to avoid unnecessary duplication of research. The cost of research plays a significant role in deciding appropriate ventures. The NIH, for example, is able to fund only about one-third of all research proposals judged worthy of support, and

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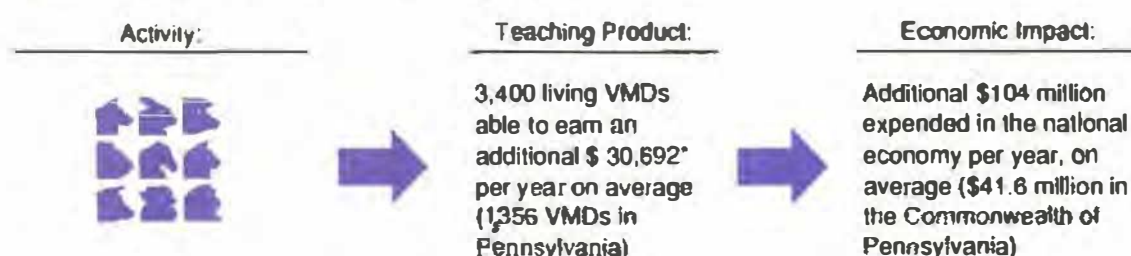
Activity Impact: Food production research reduces farmers' losses and increases their output.



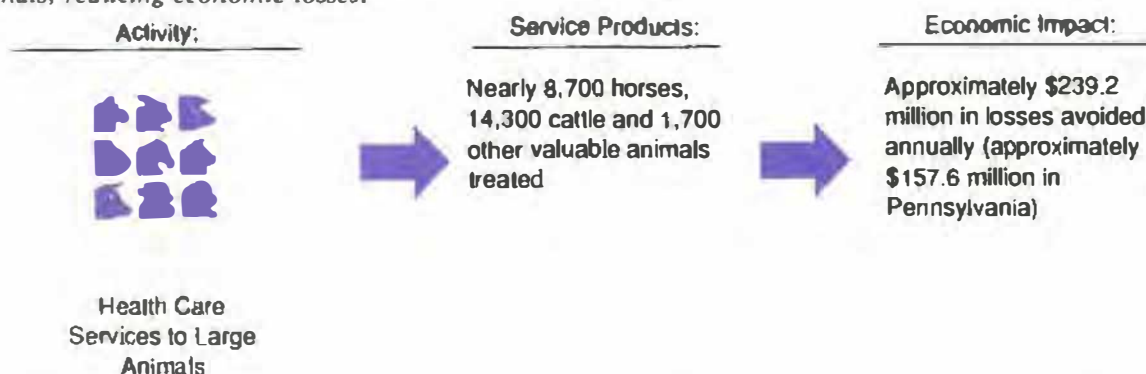
Additionally, the research into marine animal medicine at Woods Hole, Massachusetts should have a significant impact on the growing aquaculture and

biotechnology industries in the United States and in Pennsylvania.

Activity Impact: As a result of the School's teaching activities, its alumni increase their earning power.



Activity Impact: The School's services offered through New Bolton Center treat over 24,700 large animals, reducing economic losses.



Future Potential Impact: The School is involved in activities which have not yet resulted in specific, exportable products, but could potentially have a significant impact such as:

- Many sources expect the School to be an important contributor to the biotechnology industry and the aquaculture industry, among others.
- The School's investigators are researching causes, prevention, and treatment for diseases that could potentially affect about 80 million Americans.
- The estimated market for these treatments being researched is over \$70 billion annually. Such research breakthroughs will contribute to improved human health and prevention of disease.