



## Bellwether Magazine

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Volume 1  
Number 4 *Summer 1982*

Article 3

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7-1-1982

# Research in the Basic Medical Sciences

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# Bellwether

## No. 4

### Summer 1982

*Bellwether* is published quarterly by the School of Veterinary Medicine at the University of Pennsylvania, in cooperation with the University of Pennsylvania Publications Office.

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# Research In The Basic Medical Sciences

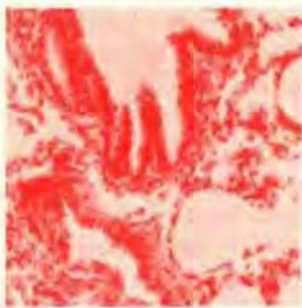
**T**he Basic Medical Sciences at the Veterinary School are organized into the Departments of Animal Biology and Pathobiology and are responsible for the education of veterinary students in the fundamentals of anatomy, physiology, biochemistry, pharmacology, microbiology, parasitology, and pathology. These disciplines are fundamental to the practice of veterinary medicine, providing the art of medicine with its rational or scientific basis.

The School is unique among veterinary schools in its commitment to basic science research. We believe research is essential to the profession and to the School for it inspires our teaching of veterinary students and it is from accomplishments in fundamental research that new avenues for treatment and prevention of both animal and human diseases are developed.

Veterinary medicine has a proud history in research. Veterinary scientists discovered filterable animal viruses, the first tumor virus, and the cause of viral encephalitis. They developed tuberculin and the test for tuberculosis, the first tumor vaccine, tetanus toxoid, and characterized *Salmonella* and *Brucella* (the latter organism causes undulant fever in humans). Veterinary scientists devised the first successful therapy for hookworm, the first electrocardiogram, provided proof of insect-borne disease and devised the first spinal anesthesia and cardiac catheterization.

Today, rapid advances in molecular biology, immunology, and the neurosciences increase the ability to use sophisticated techniques in fundamental research, which may generate exciting new information which will significantly improve the health and productivity of humans and their animals.

Fundamental research at our Veterinary School is broad and of such scientific merit that, despite the constriction of funds for research which has occurred elsewhere in the United States during the past several years, funding for research at the Veterinary School has continued to expand. This research strength is nourished by our close ties with the Medical School and the philosophy of "One University" promoted at Penn.

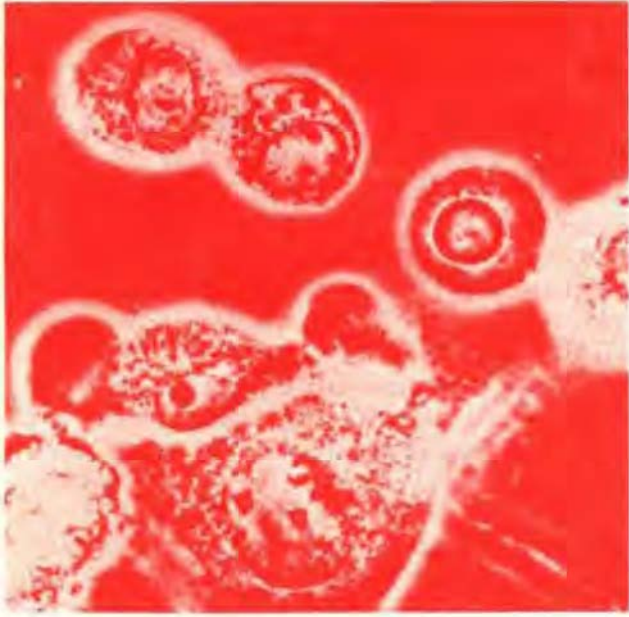


There are many current examples of our achievements in basic research. In the Laboratory of Physiology, Dr. Brinster's work involves recombinant DNA technology and the introduction of new, functional genetic material into the nuclei of eggs obtained from mice. The eggs are re-implanted into surrogate mothers and the regulation and expression of this new genetic information is followed during growth and development of recipient animals. This is of great scientific importance, and is made even more significant by the finding that the new gene is passed on and expressed in the recipient's offspring. Thus, with this powerful new research technique, there is the prospect that new genes can be introduced into economically important animals to increase their productivity and their resistance to disease. Dr. Brinster's work may also lead to methods of curing diseases caused by genetic defects in both animals and humans.

The field of genetic defects has also attracted Dr. Haskins in the Laboratory of Pathology and his colleagues, Dr. Jczyk and Dr. Patterson in the Department of Clinical Studies. They have identified the molecular error in several inherited diseases of cats. The mode of inheritance of these diseases has been worked out and these researchers are now devising methods of treatment through enzyme manipulation of the deranged systems in affected animals. As these feline diseases are models of certain human inborn errors of metabolism manifested as mental retardation, among other symptoms, the work of Dr. Haskins and his colleagues aims at improving the health of both animal and human populations.

In the Laboratory of Biochemistry, Dr. Avadhani is studying the sites of attack on the DNA molecule by aflatoxin, which is an important and lethal liver toxin affecting a wide variety of domestic species. Since it is also a potent cancer-causing agent, this property is being used to determine which are the critical targets on the DNA molecule responsible for transforming normal cells into tumor cells and how these new patterns of the gene expression are regulated.

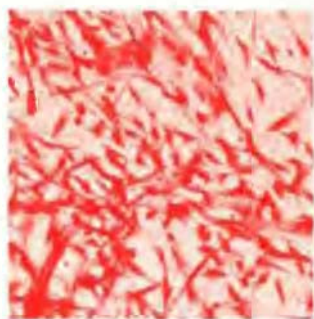
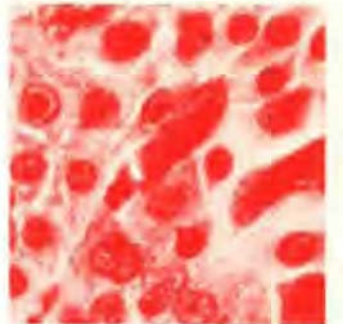
In the Laboratory of Microbiology, Dr. Lawrence is employing sophisticated DNA hybridization techniques to study herpes virus infections in several economically important diseases in domestic animals. These diseases include infectious bovine rhinotracheitis, equine rhinopneumonitis, and pseudorabies in pigs, which is a disease currently sweeping through the United States. These studies are aimed at the detection of latent herpes virus genes in neural tissues of cattle, horses, and pigs, and characterization of immunologically significant components of herpes virus for development of diagnostic tests as well as the creation of vaccines from virus subunits.



The Veterinary School also enjoys a great reputation in cardiovascular research. Dr. Detweiler, head of the Laboratory of Physiology, has set an international standard with his research in hypertension and his knowledge of comparative electrocardiography. Dr. Chacko, in the Laboratory of Pathology, has also recently received worldwide recognition for his studies of the biochemical mechanisms which regulate blood pressure through arterial wall contraction and relaxation in normal and hypertensive animals. These comparative studies will be of use in the development of drugs to control blood pressure in animals and humans. In the Laboratory of Physiology, Drs. Moore and Spear have made a fundamental contribution to our knowledge of cardiac arrhythmias. Cardiac arrhythmias result in rapid, uncoordinated beats, causing the heart to fail as a pump, and this is a major cause of death in animals and humans. Arrhythmias often occur secondary to congestive heart failure and myocardial infarction. Drs. Moore and Spear have successfully developed a chronic model of cardiac infarction in the dog and, from this, have identified a number of the mechanisms which generate lethal arrhythmias. Their research has led to a successful surgical technique which limits the incidence of lethal arrhythmias after myocardial infarction in humans. Drs. Moore and Spear are presently investigating the efficacy of a variety of drugs for the same purpose, as well as attempting to develop computerized pacing techniques to control arrhythmias when they occur.

Though we are still woefully ignorant, understanding of the complex functions of the central nervous system has greatly accelerated during the past few years. This has been achieved from a synthesis of work in many fields of neurobiology including contributions concerning the regulation of behavior from our talented group of neuroscientists, Drs. Hand, Miselis, and Morrison, in the Laboratory of Anatomy. Dr. Morrison is an authority on neural regulation of sleep and of the ways in which sleep disorders affect respiratory and cardiac function. This work has recently been extended to studies of the neural pathways of aggression. Dr. Hand uses sophisticated mapping techniques to study the pathways of somatic sensation, including pain, and Dr. Miselis is doing fundamental research on the neural control of drinking behavior and water and salt conservation by the kidney.

The Laboratory of Parasitology is the center for parasitologic studies in the University. It has acquired an international reputation from its studies in the field of immunoparasitology, research which focuses on the interactions between host and parasite, and particularly on the antigens parasites produce at various stages of their life cycle. The mechanisms controlling host immunologic responses to parasite infection are also under investigation. Furthermore, the experience gained by this and other research in the Laboratory of Parasitology places this group in a unique position to expand and initiate new research into the area of tropical veterinary parasitology. This field is neglected in the United States, but in countries of the third world is of immense economic importance to the animal industry. It is also of great public health importance, for in many instances animals act as reservoirs for human parasitic infection.



Recently, Dr. Grieve, a member of the Laboratory of Parasitology, developed a serologic test which detects antibodies produced against antigens of adult heartworms. From a diagnostic standpoint this is an important contribution to the veterinary profession. Using new techniques to recover antigens from early larval stages, Dr. Grieve is now studying ways of creating a vaccine for heartworm infection which, if accomplished, will have a significant impact upon the health of the dog population throughout the world.

Ed. Note: These few examples serve to give some perspective about the quality and range of research in the basic sciences in the School of Veterinary Medicine. In future issues of *Bellwether* we will report on basic research being done by other individuals.

*This article was prepared by Dr. Alan Kelly, professor of pathology, Dr. Wilfried T. Weber, professor of pathology, and acting chairperson of the department of Pathobiology, and Dr. Leon P. Weiss, professor of cell biology and chairperson of the Department of Animal Biology.*