Today & Tomorrow
1973-1983

The previous three decades were golden years for the School of Veterinary Medicine; the last ten years of the School's first century will be remembered as an era in which the gold was burnished to a bright glitter. During the years 1952 to 1973 the changes were spectacular, and almost breath-taking in their rapidity, and in the manner in which they altered much of the basic fabric of the School. In this last decade one is most impressed with the maturing and refining of the earlier advances, and particularly in the ability of the School to respond to challenges and to prepare itself for a future in which it will be asked to meet new responsibilities. It has now positioned itself as one of the great veterinary schools in the world. As always, the basic mission of the School continues to be that of providing educational, research and service programs concerned with direct health care for animals. However, today the School's activities go far beyond this traditional responsibility and include a major role in comparative medicine and biomedical science in general.

An Overview

Dr. Mark W. Allam resigned in 1973 and in July of that year Dr. Robert R. Marshak became the ninth dean of the Veterinary School. The transition was particularly smooth since both individuals had worked together "in harness" since Dr. Marshak's arrival at the School in 1956. Both had been the architects and moving forces behind many of the major advances made by the School, and both were individuals who were not reluctant to set challenging
goals for themselves and for the School.

One of the fundamental responsibilities of an educational institution is to be sensitive enough to perceive, and to respond to, changing needs in its sphere of activity. This is not as simple as shifting gears in an automobile! The complexities of higher educational systems, especially in a professional school with research and service functions as well as a teaching program, along with a large measure of ingrained tradition, argues against change. This has not been the case in the Veterinary School. Not only has the School been closely attuned to the times, but it has continued to exhibit a pioneering spirit in the development of new programs in all areas — education, research and service.

The core-elective curriculum, initiated in 1970, strongly reflects the School’s commitment to provide an educational system geared to the changing responsibilities of its graduates. At its inception the new curriculum met the urgent need for an educational structure which would provide a means of correlating the great mass of information to be dealt with. The curriculum has accomplished this in an admirable fashion; it is doubtful whether any of the present faculty or students would wish to return to the old style curriculum. In the last decade the core-elective curriculum has fulfilled another obligation — that of responding to the increasing demands of a profession that now has the most diverse responsibilities of any of the health professions. Not only is the practice of veterinary medicine changing, but the veterinarian is now asked to play key roles in many other areas of work. In practice, individuals with clinical specialties are becoming almost commonplace, especially in group practices. In food animal practices veterinarians are expected to be knowledgeable about such factors as herd health maintenance programs and agroeconomics. The opportunities for veterinarians in nonpractice fields have increased greatly, and will certainly continue to grow in the future. Today, the veterinarian often plays a major role in regulatory programs, in environmental and conservation activities, in public health work, and in comparative medical research. The core-elective curriculum provides an in-depth, basic education for individuals who will enter practice, and at the same time, through its elective offerings, enables students to develop specific career goals in clinical specialties, academia, research and other areas. Over and above the basic curriculum the School has also developed entirely new educational opportunities, including the Aquavet Program and the V.M.D./M.B.A. Program. In reviewing the educational mission of the School, Dean Robert R. Marshak points out that..."today veterinary students are an intellectual match for medical and dental students... We are producing (in addition to excellent practitioners) a new crop of teachers and investigators, men and women superbly equipped to tackle fundamental and applied animal and human health-related research."

A striking phenomena has been the great advances made in the depth and scope of research in all areas, and particularly in the basic sciences and in comparative medical research. Since he came to the School in 1956 as professor of medicine, Dr. Marshak has strongly advocated the role of basic principles in the teaching and practice of veterinary medicine. Today, under his guidance, the Veterinary School has an exceptionally strong commitment to basic science research. Investigators in the Veterinary School are now in the forefront in such areas as medical genetics, cardiac electrophysiology, genetic engineering, neuroscience, functional anatomy of the hematopoietic system, immunoparasitology, reproductive physiology, nutrition, and viral oncology. Much of the new information generated through basic research can be translated to dealing with animal and human disease.

Exciting contributions have been made in comparative medical research. Faculty of the Veterinary School no longer play auxiliary roles in biomedical research, but rather share an equal responsibility with the other health professions. The Veterinary School has become a world leader in the development and comprehensive study of animal models for human disease. An outstanding contribution of the School is the development, through controlled breeding, of animal colonies which perpetuate the study of inherited diseases of the eye, cardiovascular apparatus, and kidney, and inborn diseases of metabolism. Other health professions and biomedical
sciences have come to appreciate the vital role which veterinary scientists can play in unraveling some perplexing human diseases, and we are now on the threshold of an exciting future in comparative medicine — a future in which the Veterinary School will have a large stake.

In its service functions the School has evolved as the world leader in the development of clinical specialties. The efforts of Dr. Marshak, beginning in the 1960s, to recruit individuals with discipline specialties for key positions in the clinical departments is now paying huge dividends. The spectrum of clinical services offered by the Veterinary Hospital of the University of Pennsylvania, and the George D. Widener Hospital at New Bolton Center has led some commentators to characterize these facilities as the “Mayo Clinic of Veterinary Medicine”. Beyond their basic function of providing health care for animals, the two hospitals play a vital role in teaching and research.

In the face of continuing advances there have been some serious problems. Dean Marshak has often clashed with the central administration of the University on academic and management policies. The cost of providing a veterinary medical education has steadily increased, especially in the inflationary economy of recent years. As a result it has been necessary to increase tuition several times, and the School now finds itself in an unfavorable position when compared to the tuition at state-related veterinary schools. This is especially disturbing in the face of the present national decline in applications; competition amongst veterinary schools for good students is becoming more intense. The problem of providing financial aid for students has become increasingly difficult; educational costs are rising and the amount of monies available for financial aid have not kept pace. Especially disturbing is the fact that many graduates of the Veterinary School now face their first steps in professional life with staggering loan debts.
The task of dealing with these and other problems ultimately lands in the Dean's Office. Dean Marshak has provided the School with outstanding leadership and he has not wavered in his resolve to maintain the basic missions of the School at a high level, and in fact has encouraged the development of new programs when these are essential to continued growth and excellence. In his efforts Dean Marshak has received staunch support from numerous sectors. During his deanship Dr. Mark W. Allam opened many doors in generating support for the School, and Dr. Marshak has cultivated these opportunities to the fullest. He has been particularly successful in developing financial support from the Commonwealth of Pennsylvania. Basic to the continuing improvement of this vital support area has been activity of farm groups in encouraging the Commonwealth to recognize the fundamental role of the Veterinary School in the farm economy. Dr. Colin Johnstone, former associate dean for student affairs, has played a major role in cementing the relationship of the School to the Commonwealth.

Dean Marshak has exerted great effort to carry the message of the School's past, present and potential contributions to the private sector. During the period from 1976 until 1982 funds received primarily from individuals and foundations totaled 27.5 million dollars. In this area Dr. Marshak has been aided greatly by the Board of Overseers and by growing prestige of the School resulting from the scholarly activity of the faculty. Dr. Mark W. Allam, former dean, continues to lend his experience and enthusiasm to development affairs.

The Veterinary Medical Alumni Society provides a continuing source of strength for the School, both through financial support, and through the cultivation of support from individuals and various groups interested in animal health. The Pennsylvania Veterinary Medical Association has always made important contributions to advances made by the School.

The Development Office of the University has provided excellent guidance and direct assistance to the School in its fund raising efforts. Through the aegis of this office the School has organized the Friends of VHUP and the Friends of New Bolton Center, both very successful efforts, in appealing to animal owners for support. Kennel clubs, humane societies, and various groups amongst horse owners, farm associations, and other animal owners have responded to the School's needs in an admirable fashion. The faculty has aided greatly in reaching animal owners through the presentation of numerous lay seminars.

The student body, while unhappy with tuition increases and other financial problems, participates in many activities and frequently responds to special needs by taking on voluntary tasks.
As the Veterinary School closes out its first one-hundred years it is cognizant of the need to strengthen its financial base and to make certain capital improvements. In October 1983, a 41.5 million dollar campaign, known as the Second Century Fund, was undertaken. This ambitious effort was initiated with the approval of the Board of Overseers of the Veterinary School and the Board of Trustees of the University. Mr. Vincent B. Murphy and Dr. Mark W. Allam are co-chairmen for the Second Century Fund which is directed by Mr. John N. Kolb, II.

Mission Statement

The following statement, prepared by the Long Range Planning Committee and Dean Robert R. Marshak in 1980, characterizes the Veterinary School in terms of some of its major accomplishments and sets forth future goals:

To a degree generally unapproached by the leading schools in other professions, the University of Pennsylvania’s School of Veterinary Medicine leads and molds the education and practice of veterinary medicine in the nation and the world.

Our School has pioneered in the development of veterinary clinical specialties and clinical investigation, in comparative medicine, and in the development of such new fields as aquatic animal medicine, and animal/human interactions. We have successfully integrated scholarship and research into all aspects of veterinary medical education and we supply disproportionately high numbers of faculty nationwide to veterinary schools and other medical institutions. We have made continuous and significant contributions to basic and clinical research and have trained large numbers of students and faculty as biomedical research scientists. We have led the way in curriculum development, as exemplified most recently by the School’s unique core-elective curriculum, and we were the first to create programs in continuing education for American practitioners. We have maintained a professional and loyal relationship with our alumni and have established strong bonds with important agricultural associations, humane societies, dog breeders, horse breeders, and other organizations and individuals concerned with animals and animal welfare.

We have established a Center on the Interactions of Animals and Society in an effort to bring to the veterinary profession a heightened awareness of the social, behavioral, and cultural interactions of animals and human beings.

Alone, among schools of veterinary medicine, we possess both a rural and an urban campus and, owing to our biological breadth and our medical disciplines, we enjoy a special role in the University, interacting in significant ways with the Faculty of Arts and Science and the Faculties of Medicine and Dental Medicine. And, by steadfast attention to the traditional concerns of veterinary medicine, we provide, on a regional basis, the most advanced level of veterinary care and services.

As we face the future, we see extraordinary opportunities for growth and for a greater role in the mainstream of American life. Working with the livestock and poultry industries, we must strive to increase the numbers and improve the quality of the veterinary profession.
health and productivity of food animals to help meet the nutritional requirements of the six billion or more people who will inhabit the earth in the year 2000. And, as society has become increasingly sensitive and demanding about the quality of our foods and increasingly intolerant of potentially dangerous food additives and of poisons which contaminate and defile the environment, veterinary medicine has come to assume greater responsibility and greater leadership in preventive medicine and public health.

Today, more than half the families in the United States own a pet, millions of citizens derive pleasure from horses and other sporting animals, and we are increasingly aware that, beyond companionship, pet animals may in some fundamental way protect against somatic disease and early death. As a people, we have become more accepting of our animal nature and of the fundamental qualities that unite all animals. Among other things, this has led to a vigorous animal rights movement, one element of which clearly aims to eliminate the use of animals in medical research. Thus, the ancient profession of veterinary medicine has responsibility for the delivery of highly sophisticated care of our pet and sporting animal populations and for guiding society through the highly politicized thicket of animal rights vs. scientific need, to a sensible and appropriate value system on how animals may be used.

Despite austere financial circumstances and the realization that veterinary medicine lacks the third party payments and subsidizations taken for granted in other medical cultures, we believe that our School is on the threshold of its most productive era and that we must continue to take broad responsibility for matters relating to the health and welfare of animals and man. We shall continue and amplify our contributions:

- To the health care and protection of food and fiber producing animals, companion and sporting animals, and laboratory animals;
- To the health care, protection and preservation of zoo animals and wildlife, including aquatic species;
- To the diagnosis, surveillance and control of diseases transmissible from animals to man, and to protection against environmental hazards which threaten animal and human health and safety;
- To the health aspects of the production, processing and marketing of foods of animal origin;
- To veterinary and comparative medical research and the application of research findings to animal and human health needs;
- And, to expansion of veterinary medical interests, encompassing virtually every significant aspect of the interactions of animals with human beings and with the environment.

Thus, stated in simplest terms, the mission(s) of the School of Veterinary Medicine is to:

- Train a highly qualified body of general practitioners, appropriate numbers of specialists, and biomedical scientists equipped to meet society's present and future needs;
- Create new knowledge through fundamental and applied biomedical research, including behavioral research, with particular emphasis on disease of domestic animals and on animal homologues of human disease through systematic development of the School as a center for comparative medicine;
- Develop and maintain facilities and systems for the delivery of veterinary medical services on a regional basis, especially sophisticated care not generally provided by veterinarians in private practice;
- Offer quality continuing education programs aimed at refreshing and advancing the knowledge and skills of practicing veterinarians;
- Broaden the contributions of veterinary medicine to society through the development of new disciplines and specialties, for example, aquatic veterinary medicine, veterinary social work, and advanced animal technician training programs.

We take cognizance of the fact that in our complex School, as in our complex larger Society, we must satisfy legitimate and essential needs which may at times be incompatible with one another — either on philosophic or operative grounds. We must find our way, meeting the demands for research, teaching, and patient care, by means of information sharing, thoughtfulness, tolerance, and a long-range collegial view.
Policies and Procedures

By 1983 the Veterinary School had grown to a large concern, one that required a strong administrative structure and a carefully conceived body of operating policies and procedures. Not only had the School grown in terms of people and physical plant but it had matured in terms of what the institution expected of those who were part of it, and what the individual expected of the School. The rights and responsibilities of faculty, students and supportive staff were brought more sharply into focus and it became necessary to define them in a formal fashion. The budgetary apparatus required the presence of individuals who were experts in financial matters, and in computer programs.

The Philadelphia Campus now has a large, four story hospital in addition to the old quadrangle building and the Rosenthal building. The New Bolton Center Campus has blossomed to over 1,000 acres with over seventy buildings. Over 475 people are now employed at the two campuses with 191 of those being present at New Bolton Center. There are over 140 total faculty (Academic Personnel) in residence, sixty associated faculty, and eleven emeritus professors. In 1982, the total operating budget was just over $21 million, and the research budget was over $6 million.

The days when the Dean's Office was almost a one person operation, with a few secretaries in support, are a matter of the past. The responsibilities of this office now require four associate deans, an administrative assistant, a director of budget and finance, and a supportive staff with specific areas of responsibility such as admissions, curriculum, and student financial aid.

Gone also are the days when faculty appointments were a simple procedure, requiring only the presentation of a superficial amount of information about the appointee at a faculty meeting. Today appointments originate with the department and pass through a series of evaluations including a faculty committee, the Dean's Office, and the Provost's Office. The supportive information for an appointment must include a curriculum vitae, letters of evaluation from individuals familiar with the candidate and his/her work, and evaluations by a panel of outside experts. Each step of the evaluation procedure includes careful scrutiny of the individual's qualifications.

Gone too is the rather arbitrary procedure for evaluating students. This has been replaced by a set procedure including the scheduling of examinations, and a careful evaluation of each student's performance by a faculty committee and the Dean's office. There is a system whereby students may appeal decisions, and the associate dean for student affairs acts as an ombudsman and as a channel for assisting students who are in academic difficulty.

The rights and privileges of faculty and students are spelled out in the Manual on Policies and Procedures of the Veterinary School and in University documents. The School has standing committees on Academic Freedom and Responsibilities and on Student Rights and Responsibilities.

Departmental Structure

Sheldon Hackney is now president of the University; the provost is Thomas Ehrlich, and Thomas W. Langfitt is vice president of health affairs.

In the School of Veterinary Medicine, four associate deans serve under Dean Robert R. Marshak. They are: Donald A. Abt, V.M.D., associate dean; Richard A. McFeely, V.M.D., M.Med.Sc., associate dean for New Bolton Center; Joseph F. Skelley, V.M.D., associate dean for admissions, continuing education and student affairs; and Barry J. Stupine, associate dean for administration, Small Animal Hospital. Colin Johnstone, B.V.M.S., M.R.C.V.S., Ph.D., served as associate dean for student affairs until July, 1983, when he resigned and his duties were taken over by Dr. Skelley. Mr. Peter Olds-Clarke is director
of budget and finance. Mrs. Helen J. Linwood is assistant to the dean for admissions and academic affairs, and John E. Martin, V.M.D., is special assistant to the dean.

The School is made-up of four departments, each of which has a chairperson. Each department consists of several laboratories representing academic disciplines or, in the case of clinical departments, sections which represent clinical specialties. The departments and their subunits are: Department of Animal Biology, chairman, Leon P. Weiss, B.S., M.D. This department is comprised of the Laboratory of Anatomy, Peter J. Hand, V.M.D., Ph.D., head; Laboratory of Biochemistry, Adelaide M. Delluva, Ph.D., head; Laboratory of Pharmacology and Toxicology, Carl E. Aronson, Ph.D., head; and the Laboratory of Physiology, David K. Detweiler, V.M.D., M.S., D.Sc., head.

Department of Pathobiology, chairman, Wilfried T. Weber, D.V.M., Ph.D. This department is made-up of the Laboratory of Microbiology, Wesley C. Wilcox, M.S., Ph.D., head; Laboratory of Parasitology, Robert B. Grieve, M.S., Ph.D., head; Laboratory of Pathology, John T. McGrath, V.M.D., acting head; Laboratory of Large Animal Pathology, Helen M. Acland, B.V.Sc., head; and the Poultry Diagnostic Laboratory, Robert J. Eckroade, D.V.M., M.S., Ph.D., head. During 1983, Dr. Weber was on sabbatical leave and Alan M. Kelly, B.V.Sc., M.R.C.V.S., Ph.D., functioned as acting chairman of this department.


Dr. Joseph F. Skelley, associate dean for Admissions and for Student Affairs.

Mr. Barry Stupine, associate dean for administration, Small Animal Hospital.

Dr. Leon P. Weiss, Grace Lansing Lambert Professor of Cell Biology (left) receives honorary membership in the Pennsylvania Veterinary Medical Association from Dr. George Meerhof, president, 1981.

Dr. Wilfried T. Weber, professor of pathology; chairman, Department of Pathobiology.

Dr. Kenneth C. Bovee, Corrine R. and Henry Bower Professor of Medicine; chairman, Department of Clinical Studies (Philadelphia).

Dr. Charles F. Reid, chairman, Department of Clinical Studies, New Bolton Center.
Faculty Committees

The business of the School, academic and otherwise, is largely conducted through a committee structure, operating under the regulations established in a manual on Operating Procedures and Policies. This document, which is a product of much work by a committee chaired by Associate Dean Donald A. Abt, carefully defines the various components of the School, and delineates their function. For example, Standing Faculty is defined as being all fully affiliated personnel holding the rank of professor, associate professor and assistant professor; Academic Personnel refers to the Standing Faculty plus all associates, instructors, residents, interns, post-doctoral fellows, and graduate students in residence. The document specifies that meetings of Academic Personnel are held twice annually, in October and April; unless specifically designated otherwise in the Operating Procedures and Policies only Standing Faculty have the right to vote in these meetings; others may participate in deliberations.

The manual on Operating Procedures and Policies designates that at least seventy-five percent of the Academic Personnel on each standing committee shall be members of the Standing Faculty. In 1983, there were the following standing committees: Chairpersons Committee, consisting of department chairman and responsible for acting upon academic and related matters which affect the School. Standing Committee on Appointments and Promotions, composed of nine members, all full professors. This important committee is responsible for receiving nominations for appointments and promotions, making recommendations to the dean, and ensuring that appropriate uniform procedures and standards are applied in various departments. All appointments and promotions are initiated by the department. Committee on Committees, which has the responsibility to nominate for election or appoint persons, as appropriate, to all standing committees and to the office of secretary of the school. This committee has four student members. Education Committee, which is responsible for the overall educational program of the School, and initiates, receives, considers proposals and implements decisions concerning the curriculum and all related matters. This committee, in consultation with the Admissions Committee, sets the minimal educational requirements for admission to the School. Four students are members of this committee. Library Committee, which is responsible for the policies and activities of the two School Libraries. This Committee, which contains four students, advises the librarians on subscriptions to periodicals, selection of reference titles, addition of new books and withdrawals of old journals and books. Admissions Committee, which judges all applicants and selects students to be admitted to the School in accordance with the Principles Concerning Admissions approved by the faculty. This hard working group has four student personnel. Committee on Academic Status of Students, which is responsible for providing guidelines for evaluating standards of academic performance, determining the academic status of students, and recommending each student's promotion or dismissal. Long Range Planning Committee, which performs specific tasks related to long range planning as requested by the dean or Chairpersons Committee, but may also initiate studies on its own initiative. This committee has an alumni member and two students among its personnel. Audio-Visual Committee, which is responsible for providing audiovisual support for the academic program, planning and coordination of future endeavors in the Audio-Visual field and coordination of audiovisual affairs with other areas in the University and extramural institutions. There are four student members on this committee. Committee on Academic Freedom and Responsibilities, which functions to protect the principles of academic freedom and responsibility endorsed by the University. It is concerned with the proper operation within the School of the official Procedures Relating to Academic Tenure, and is available to advise faculty members on these principles and procedures. Committee on Student Rights and Responsibilities, which has eight students among its membership, and is responsible for matters relating in general to student rights and responsibilities. This committee functions to protect the rights and privileges of
students, administer the Code of Student Rights and Academic Integrity, and to inquire into other possible breaches of good conduct. Finance Committee, which is responsible for development and implementation of the School budget and all related fiscal matters. Animal Care Committee, which amongst its membership contains one student and a member of the community who has an interest in the humane care of laboratory animals. This group is responsible for the development and monitoring of policies and procedures for the humane care and use of animals in teaching and research within the School. This committee reviews protocols for all teaching and research procedures that utilize animals, to insure that unnecessary pain and discomfort are avoided and that methods used for their alleviation are the most effective available. The committee reviews all cases of alleged violation of the principals of humane care and use of animals. Space Committee, which is made up of two groups, one for the Philadelphia Campus and one for the New Bolton Center Campus. This committee has the responsibility for the assignment, use and maintenance of space on each campus, including the development and review of long term plans to meet the space requirements of the School. Student Advisory Committee on Admissions, which is made up of twelve members of the student body and is responsible for formulating recommendations concerning the admission policy and the evaluation of applicants for admission to the School. This group performs the very useful function of assisting applicants to obtain information about the School. Four members of this committee serve on the Admissions Committee.

The Board of Overseers

One of the sources of strength for the School of Veterinary Medicine is the bridge that it has built to the world beyond its campus. One group that helps the School evaluate its strengths and weaknesses and meet its professional and community obligations is the Board of Overseers.

In 1928, the University statutes provided for the formation of Advisory Boards which would offer counsel to various faculties, but it was not until 1956 that an Advisory Board was listed in the Bulletin of the School of Veterinary Medicine. The Chairman of this board was Mr. Orville H. Bullitt, and since that time the importance of this group in the affairs of the Veterinary School has grown steadily. In 1973 its name was changed to the Board of Overseers.

The University guidelines describe the Board of Overseers as an advisory body to the president, the provost, the trustees, and the dean of the school. Appointment to the Board of Overseers rests with the Executive Board of the Trustees who act upon recommendations made by the president after consultation with the provost. The Board of Overseers of the Veterinary School meets two or more times yearly; working committees of the Board meet more frequently. These sessions enable the dean and the central administration to refine objectives, review the school's progress and problems, assess strengths and weaknesses in relations to the needs of the community and the nation, and consider long-range goals and priorities. The overseers also provide consultation to components of the school in accordance with individual expertise. Occasionally they assist in identifying sources of support.

Ideally a board's membership should represent a broad balance among scholars, practitioners, alumni and non-alumni, as well as knowledgeable men and women from various walks of life. The Veterinary School Board of Overseers represents each of our major constituencies. There are educators, prominent livestock and horse owners, dog fanciers, University trustees, representatives of State government, organized agriculture, the Alumni Society.
and the humane movement, as well as individuals who are best described as committed animal lovers.

In the past years the board was loosely organized. It now functions through various committees on Planning and Development, Membership and Visitors, Education, Government and Community Relations, and Management and Facilities.

Lest that anyone think that these busy and important people convene regularly merely to view a dog or pony show, or to deal with matters of small consequence, it should be known that their record of service to the school speaks otherwise. They have advised on such weighty matters as the appropriate relationship with the Commonwealth, fiscal planning and management practices, and the overall performance of the Dean’s Office.

In 1983, the Board of Overseers had the following membership: Dr. Kenneth W. Allen; Mrs. David Banks; Dr. Nancy O. Brown; Mr. Roger Caras; Ms. Christine Connelly; Mr. John D. Cope; Mr. H. Richard Dietrich; Mr. Keith Ecker; The Honorable Penrose Hallowell; Mr. Max C. Hempt; Mr. John D. Hoffman; Mr. Philip Hofmann; Dean E.J. Kerusting; Mrs. Gerard B. Lambert; Mr. Walter Mannheimer; Mrs. Richard E. McDevitt; Dr. W. Edward McGough; Mr. Henry S. McNeil, Jr.; Mr. J. Maxwell Moran; Mr. Vincent B. Murphy, Jr.; Mr. Richard W. Newpher; Mr. Charles Ord; Mrs. Joan Ferguson Pew; Mrs. David Rockefeller; Dr. David E. Rogers; Dean Samuel H. Smith; Mr. W.B. Dixon Stroud; Mr. Oakleigh B. Thorne; Mr. Robert Whitaker; Mr. Robert Williams; Mr. Charles E. Wismer, Jr.; Mr. Charles Wolf.

The Clinician-Educator Track

In December, 1982, the faculty established a new category of full-time, fully affiliated faculty known as the Clinician-Educator Track. This action was the result of recognition that service and teaching obligations to the School require a category of faculty who do not, by the very nature of these obligations, satisfy the criteria for progress in the traditional tenure track. Clinical service is an integral part of the teaching mission of the faculty in the clinical departments. In the past, proficiency and evaluation in the dual functions of service and teaching has been difficult in relation to the conventional research productivity in the process of academic promotion.

Faculty in the Clinician-Educator Track have a non-tenured status. Appointments to this new category are made on recommendation of department chairpersons to the Committee on Appointments and Promotions and to the dean. Appointments follow the traditional route of evaluation except for criteria involving research requirements for tenure.

Clinician-educators are required to devote full-professional time to activities in behalf of educational and service functions of the School.

Funds generated by the clinician-educator through work in the clinical services must be sufficient to cover an appropriate portion of the academic base salary, benefits and overhead. The department chairman must inform the individual clinician-educator each year of the proportion of salary he is expected to generate. In cases where patient care is the predominant activity of the clinician-educator, an appropriate portion of salary, benefits and overhead may be the entire amount. In other cases, the appropriate portion may be less than the entire amount due to the type of patient, time necessary to develop clientele, or other academic duties assigned within the department. Clinician-educators share all rights and privileges of other Standing Faculty of the School.
In creating this new category the faculty established that at no time shall the voting strength of faculty members in the Clinician-Educator Track exceed twenty-five percent of Standing Faculty, and at no time shall more than thirty percent of the standing faculty in any clinical department be on the clinician-educator track.

**Evaluation of Students**

In 1982 a new grading system was put into effect for the incoming class, that is, the class of 1986; each subsequent incoming class would be under the new system which uses the letter designations A, B, C, and F and Incomplete for grading students. The old system, employed Excellent, Pass, Incomplete and Failure as grades. In the old pass-fail system cumulative weighted grade averages were computed on the basis of all previous course work. In the calculation of the weighted grade average Excellent was equivalent to a relative score of three; Pass to a relative score of one, and Failure or Incomplete to zero. The cumulative weighted grade average, calculated at the beginning of the third and fourth years, was used to determine interim class ranks for use of the faculty and Dean’s office. The interim class ranks were not entered on the official transcript of the School.

The new system utilizes Grade Point Averages (GPA), which are computed and placed on the transcript of each student each academic year. In the calculation of GPA’s, the letter grades, A, B, C and F and I are assigned numerical values of 4, 3, 2, 0, and 0 respectively. In this system annual and cumulative GPA values are used to determine individual class rankings for the use of the faculty and Dean’s office in making recommendations on behalf of students.

The Dean’s List for the pass-fail system consisted of those students with a weighted grade average of 1.75 for a particular year; under the new system the Dean’s List is made up of students with a GPA of 3.30 for a particular year. Under both systems provision is made for students to graduate with honors based on class ranking. The three categories of honors are: Summa Cum Laude, Magna Cum Laude, and Cum Laude. In general, each category is comprised of five percent of the graduating class, plus or minus two percent.

The faculty has established specific guidelines for examining students. All students must be informed, at the beginning of a course, of the evaluation procedures to be used for that particular course. The total number of examination hours permitted in each course is determined by the number of credits assigned to a course. All courses are initially permitted one hour of examination time; courses with more than one credit are allowed forty-five minutes for each credit in excess of one. The maximum time permitted for formal examinations during any one day is four hours.

Grades for students are submitted to the Committee on Academic Standing of Students (CASS). This Committee has the major responsibility of making decisions on those students in academic difficulty. The decisions of CASS are referred to the Dean’s Office, which informs students of these decisions.

In order to progress from one academic year to another, a student must receive a passing grade in each core course. Students are not required to obtain a passing grade in each elective course but they receive credit toward graduation only for those electives in which they obtain a passing grade. Students who do not pass core courses may be granted the privilege of repeating the course once, or they may be granted the privilege of a re-examination, at the discretion of CASS. Students have the right to appeal decisions of CASS.

All of this may seem somewhat cumbersome but the system is a great improvement over the situation that existed for many of the graduates of the School in which there was no restriction on the number of examinations given on any particular day or in which students in academic difficulty, or with course failures, had little recourse. The creation of the position of associate dean for student affairs was an important step forward; this individual functions as a channel for students to discuss their problems and to receive counseling. In all, it is a much more considerate, fairer system.
Although information about loan funds available to students began to appear in the Veterinary School Bulletin as early as 1960, it was not until the 1970s that the problem of providing aid for students assumed a crucial role in academic life. It was during these years that the cost of education underwent a sharp increase. Despite the fact that the administration of the Veterinary School has made a determined effort to hold down tuition, there has been a significant increase since 1970. The following figures indicate the upward spiral of tuition for Pennsylvania residents and contract students (tuition for all other students is shown in parentheses): 1970, $2,050 ($2,650); 1975, $4,390 ($4,990); 1977, $5,500 ($6,500); 1979, $6,660 ($7,900); 1980, $6,660 ($7,900); 1982, $7,990 ($9,490); and 1983, $9,176 ($10,900).

The increased cost of providing an education is the result of many factors, primarily increased costs of equipment and operating expenses of the School, and faculty salaries. A basic problem at the University of Pennsylvania Veterinary School relates to the proportion of the School’s budget which comes from a state appropriation. Being a private school, only about thirty-five percent of the total annual budget is derived from money appropriated by the Commonwealth of Pennsylvania. In the academic year 1980-1981, comparable percentages for some other veterinary schools were: University of California, Davis, 65 percent; Colorado State University, 68 percent; Cornell University, 54 percent; and Texas A and M University, 66 percent. Schools receiving those higher proportions of their budget from state appropriations are able to maintain their tuition at a much lower level than the University of Pennsylvania. This is evident in the following tuition charges at various schools for 1980-1981: University of Pennsylvania, $6,600; Cornell University, $5,832; Ohio State University, $1,839; University of California, Davis, $742; and Texas A and M University, $600.

A major difference in the operation of this School versus state schools is the fact that the University of Pennsylvania pays for construction and operation (utilities, maintenance) of its buildings, whereas at state schools these costs are assumed by the state.

Although there is no known case in which a student enrolled in the Veterinary School has withdrawn for purely financial reasons, the loan debt accumulated by students is becoming increasingly critical. A survey of fifty-seven students in the graduating class of 1981, revealed a total accumulated loan debt of $1,827,328. The range of debts for individuals was from $15,800 to $49,450, and the median debt was $33,725. A private survey at this time indicated that the total manageable educational debt for a starting annual income of $20,000 was $11,412. Thus, many students graduating from the Veterinary School begin their professional life in a very precarious financial situation.

Older graduates of the School may recall that they were often able to help defray their educational costs by working while attending school. Today’s demanding curriculum, especially the hours students spend in clinical studies and off-campus clinical rotations, makes it very difficult for them to work while going to school. However, faced with a crunching financial problem most present students do everything possible to help their situation.

The Veterinary School’s administration is in constant search for additional funds, especially scholarship aid, to ease the financial plight of students. Despite this effort, and the fact that scholarship funds have increased slightly in recent years, the situation remains critical. In 1983 there was approximately $95,000 available in scholarship aid. Alumni, professional associations, industry, and various groups interested in animals (humane societies, kennel clubs) have been responsive to the need but much more help is required.

The overall Student Financial Aid Program for the Veterinary School includes loans and scholarships administered by the School and loan money supervised by the University Office of Graduate Financial Aid. At present, Dr. Joseph Skelley, associate dean for student affairs, and Dr. John E. Martin are responsible for administering scholarships and loan funds held by the Veterinary School. Disbursement of these monies is on a need basis. Financial aid applications for University-supervised funds are analyzed by the
Graduate Aid Officer of the University Office of Graduate Financial Aid, and funds are disbursed after consultation with Veterinary School representatives. The two major loan funds administered by the University are the National Direct Student Loan (NDSL) and the Health Professions Loan. Both of these represent money appropriated to the University by the federal government; the amount of money available each year in these loan funds varies. These are preferable loans since the interest rates are relatively low and the student is not required to repay them until after graduation.

In addition to these “in house” loans most students qualify for one or more loans that can be obtained directly from a bank or other lending agency.

Curriculum

In the light of its subsequent history, the Core-Elective Curriculum, initiated in 1970, must be viewed as a major success of the educational program of the Veterinary School. In summarizing the first five years experience with the new curriculum, Dean Robert M. Marshak stated that as an educational program “it offers the best approach to the problem of meeting national needs.” This statement is even more apropos today with increasing and more diverse responsibilities of the veterinary profession.

The curriculum has enabled the educational program to emphasize the need for students to become well-grounded in understanding and problem solving rather than in mere encyclopedic memorization. The curriculum, throughout, stresses the importance of the student developing a firm grasp of principles of veterinary medical science and biological science in general. The program fosters a high degree of self-education, and the elective portion compels students to assume a useful degree of responsibility for their educational experience. Both situations serve them well after graduation. Unlike the old type of curriculum which was in force for almost ninety years, the core-elective program offers students the opportunity of an individualized educational experience, and provides the means for them to develop specialties, a major trend in the veterinary profession today. Dean Marshak points out that “knowledge growing out of research is the most potent force in determining the nature of veterinary practice.” Through the independent study and research phase of the curriculum students are exposed to research and, in fact, have the opportunity of engaging in research projects.

Like almost any major advance, the proved advantages of the core-elective curriculum have not been achieved without some problems. Compared to traditional educational systems the core-elective program is infinitely more complex and expensive. Associate Dean Donald A. Abt and his staff are required to spend great amounts of time in administering the program. The preparation of an annual, detailed course guide is essential and calendar precision is critical.

The development of the core-elective program and its operation have proved to be a highly beneficial faculty experience. The process required the faculty to examine what really lies at the core of modern veterinary medical education, discipline by discipline. This process uncovered much redundancy in the material taught and forced adjustments of inappropriate time allotments for various disciplines. The result of this exercise was the elimination of outmoded, wasteful material from the curriculum, and the introduction of new material to keep pace with the changing responsibilities of the profession.

In 1983 the core-elective curriculum was made-up of forty-three core courses and 102 formal electives. In terms of hours, the core portion made-up approximately 72 percent of the total curriculum. The core portion extends over the first and second years and half of the third and fourth years. All students must complete this part of the program. Students apply for electives they have selected, and while limitations of space, equipment and staff restricts enrollment in certain electives, every effort is made to accommodate the needs of students. There are no formal limitations on the number of courses or credits permitted in a given quarter; however, students are cautioned against overburdening themselves in any particular quarter. In addition to the
elective courses offered in the Veterinary School students may apply for electives given outside of the School; for these, prior approval must be obtained from the Education Committee.

The fourth year program is divided into twenty-five two-week rotational periods covering a twelve month period, beginning immediately at the end of the third year and continuing until graduation. The core segment of the fourth year consists of seventeen clinical assignments (rotations) spread over eight and one-half months. The remaining rotational periods are devoted to elective choices of the student and a vacation period of up to two weeks in duration. These electives include the opportunity of off-campus work at such locations as the Animal Medical Center, New York City, or at other institutions.

Students may elect to engage in formal or informal research courses and independent study. In many cases the student may correlate his/her research interests with those of individual instructors. An independent study course may be developed at other institutions, or under certain circumstances such work may take part within the framework of a job for pay, providing that the activity is academically enriching for the student. For graduation a student must satisfactorily complete all core courses and accumulate no fewer than one-hundred elective credits.

**Faculty Retreat — 1982**

The complexity and the flexibility of the core-elective curriculum dictate that it be examined at intervals in order to assure that it is meeting its primary objectives. One of the outstanding features of this program is its flexibility in meeting the changing needs of the profession; new elective courses can be added as the need demands and outmoded courses can be deleted. However, these changes must be made only after careful consideration of many factors. In 1975 and 1978 the experience with the core-elective curriculum was examined and some changes were made. These were mainly in the division of time allotted to the core and elective portions of the program. When it was initiated in 1970 the core portion made up about 65 percent of the total hours in the curriculum; the core segment now accounts for about 72 percent of the program.

By 1982 it was evident that there was a need for a full-scale, critical examination of not only the curriculum, but also of teaching methods. The decision to do this coincided with the University's heightened concern about teaching. In 1980, Associate Provost Benjamin S.P. Chen appointed a Task Force on the Quality of Teaching, chaired by Dr. Robert E. Davies of the Veterinary School. This group, after a detailed survey, found evidence of excellent teaching within the University but also pinpointed areas that were in need of improvement. Thomas Ehrlich, now provost, issued a statement in 1981 in which he stated that his office would work closely with the deans and faculties of the various schools to implement the recommendations of the task force. Among the areas to receive attention are the need to increase public recognition of, and reward for, excellent teaching, the need to examine the role of graduate students and junior faculty in teaching programs, and expanding and improving the structure for student evaluation of teaching performance.

In October, 1981, the Dean's Office of the Veterinary School scheduled a three-day faculty retreat for the purpose of examining the curriculum and teaching. The retreat, which was developed under the superb guidance of Associate Dean Donald A. Aht, was held at New Bolton Center. A very high percentage of the faculty took part in the retreat; student representatives and faculty from other institutions were also present. The program was divided into three major sections, each to examine the following areas: The Quality of Teaching; Factors Influencing the Curriculum; and The Core-Elective Curriculum. Some of the major items examined under these headings were the development of methods for evaluation of teaching performance, interactions between postgraduate education programs and the veterinary curriculum, desired character-
istics of students after graduation, student stress, the grading system, admission procedures, sequencing core and elective courses, redundancy and deficiencies in subject matter, utilization of elective opportunities, the role of adjunctive teaching aids, the responsibilities of teachers, and a consideration of veterinary education for the future.

This was a laudable effort on the part of all who participated in the retreat; many good recommendations evolved from the twenty-four workshops that made up the program. The faculty exhibited an open-minded, and sincere desire to make changes when necessary and especially to develop methods of improving teaching. Many of the recommendations require careful study and this is now being done. One of the first recommendations to be acted upon involved a change in the grading system. In 1982, this was changed from a pass-fail system to a system using the letter grades A, B, C, and F.

Special Programs

The Veterinary Medical Scientists program, which was discussed in the previous chapter, continues to offer two or three outstanding students each year the opportunity to earn combined V.M.D./Ph.D. degrees in a period of six or seven years.

The V.M.D./M.B.A. Degree Program, initiated in 1982, is a program for specially motivated students whose career goals are both veterinary medicine and business. It is a combined course, involving five to six years of study, offered by the Veterinary School and the Wharton School of the University of Pennsylvania and leads to the V.M.D./M.B.A. degrees. This program was developed in recognition of the growing need for veterinarians with a business background, especially in the food producing industry. Veterinarians have become increasingly involved with agroeconomics, that is, in working with farmers to achieve more economical production of meat, dairy, poultry and animal fiber products. Likewise, a veterinarian operating a small animal hospital must provide efficient health care at an affordable level, and lacking the services of a hospital administrator, veterinarians generally act as their own business agents.

The Aquavet Program is designed to initiate the training of students in Aquatic Veterinary Medicine and consists of formal course work and related laboratory research associated with the application of the traditional talents and knowledge of the veterinarian to the problems of aquatic animal species. The program was initiated in 1976 through the combined interests of marine biologists, aquaculturists, and veterinarians. Aquavet is a joint venture of the School of Veterinary Medicine at the University of Pennsylvania and the New York State College of Veterinary Medicine at Cornell University. The program is directed by Dr. Donald A. Abt of the Veterinary School, and Dr. Charles G. Rickard, associate dean and professor of pathology at Cornell. Other cooperating agencies are the Marine Biological Laboratory, the Woods Hole Oceanographic Institution, and the Northeast Fisheries Center of the National Marine Fisheries Service. Several members of the Veterinary School faculty participate in the course.

Aquavet is a summer program conducted at Woods Hole, Massachusetts. Students participating in the four week program earn academic elective credit toward graduation. Participants for the course are selected on a competitive basis; the Admissions Committees at Penn and Cornell select eight students each. Sixteen other places in the course are filled by selection of applicants by Drs. Abt and Rickard, and comprise students from other veterinary schools and graduate veterinarians.

The Aquavet course includes consideration of the salt marsh ecologies, inter-tidal zones, and off-shore areas. Students use their knowledge of comparative anatomy to compare and contrast aquatic animals with those species commonly encountered by the veterinarian. They explore the relationship between the marine animal and its habitat and learn how the environment may influence the interaction between disease producing agents and the animal. Drawing on their basic background in epidemiology, parasitology, genetics, nutrition, toxicology and other fields students seek solutions for problems which afflict marine animals. Diseases are studied and compared to those in terrestrial animals.
Students participating in Aquavet Program, Woods Hole, Massachusetts.

and the food chain and ecosystem for marine animals are investigated.

Following this formal introductory course a limited number of students are selected to pursue an eight-week period of research which involves an in-depth investigation of some particular problem. This may be done at Woods Hole or at a cooperating institution.

In 1983 a new phase of the Aquavet Program was introduced. This course, Aquavet II, considers Health Management in Confined Populations of Invertebrates and Fish.

In 1983 the Veterinary School, in cooperation with Pennsylvania State University, initiated the Joint University Scholars Program. The purpose of this unique program is to identify, each year, at Pennsylvania State University a limited number of students whose career objective is to attend the School of Veterinary Medicine at the University of Pennsylvania. Under this program students who are selected will be granted early admission to the Veterinary School. Under the terms of the Program, which will function within the framework of the general University Scholars Program at Pennsylvania State University, early admission means early identification and acceptance of the student. For entry into the Program applicants will be screened by a Screening Committee at Pennsylvania State University which will then recommend a list of qualified applicants to the Joint University Committee. This committee is composed of two faculty members from each of the schools. The Joint University Committee will designate those candidates provisionally worthy of being designated as University Scholars, and these will be advised to apply to the Veterinary School. The final decision for admittance or rejection to the School of Veterinary Medicine will be made by the Admissions Committee of the Veterinary School.

Another special program at the Veterinary School is the Short Term Research Training Program. This is a program specifically designed by the National Institutes of Health to attract some of the highly qualified professional students into various biomedical and behavioral research programs and to help stimulate their research interest through short term training. The overall objective is to help realize opportunities inherent in a research career by direct participation in research and exposure to a stimulating research environment. Trainees receive a stipend for a maximum of three months per year. For the summer of 1983 approximately twelve research fellowships were available. The program is under the direction of Dr. Narayan G. Aradhani, professor of biochemistry.

In cooperation with Harcum Junior College, Bryn Mawr, Pennsylvania, the Veterinary School provides didactic and clinical training for approximately eight veterinary medical technicians each year. This is a two year program in which students spend almost the entire second year in the clinics and laboratories of the Veterinary School. Many of the individuals who serve in the Nursing Service of the Veterinary Hospital of the University of Pennsylvania and the George D. Widener Hospital for Large Animals are graduates of this program. Dr. Sheldon A. Steinberg, professor of neurology, is director of this program for the Veterinary School.

Graduate Program

The Graduate Group in Comparative Medical Sciences was created in 1970 to provide for the special interdisciplinary graduate training required by academic clinicians interested in research on basic mechanisms of disease. Previously, veterinarians who wished to pursue academic careers in various areas of clinical specialization could attend the Graduate School of Medicine, but this was phased out. The Graduate School of Medicine offered a M.Med.Sc. degree, whereas, the Graduate Group in Com-
Comparative Medical Sciences offers either a masters degree or a Ph.D. degree. Only students with a veterinary, dental or medical degree are eligible for admission. Since its inception thirty-six veterinarians and one physician have been admitted to the Graduate Group in Comparative Medical Sciences. Of these, ten have received masters degrees, and eight have received the Ph.D. degree. Fifteen students are currently enrolled (1983). Dr. David K. Detweiler is chairman of the Graduate Group of Comparative Medical Sciences and Dr. Donald F. Patterson is assistant chairman.

The School continues to offer opportunities for graduate work in a number of biomedical fields, including anatomy, biochemistry, biology, biophysics, immunology, microbiology, molecular biology, parasitology, pathology, pharmacology, physiology and psychology. Students undertaking graduate work are registered in the Faculty of Arts and Sciences. Many of the faculty in the Veterinary School have joint appointments in the Faculty of Arts and Sciences.

Continuing Education

The Continuing Education Program of the Veterinary School offers practitioners the opportunity to keep apprised of scientific advances in this era of rapid proliferation of knowledge. The Faculty of the School regards graduation as merely a midway point in the continuum of veterinary medical education. Today's Continuing Education Program is highly organized; this was not always the case, but for many years the faculty provided the means of postgraduate clinical education through offering a series of short courses in such subjects as general and orthopedic surgery, dermatology, radiology, and cardiology and other clinical specialties. These courses were always oversubscribed and set national standards for quality in clinical education. Further, for a number of years the faculty of the Veterinary School participated heavily in short-courses, conferences and symposia on a national and international level. The Penn Annual Conference, begun in 1900, continues to be an important part of the Continuing Education Program and provides ten clock hours (1 credit) of continuing education credit. The Conference offers the dual advantages of a formal environment for learning as well as an opportunity for informal one-on-one discussions with experts in many fields.

Today, there is a move to make continued licensure contingent upon the practitioner engaging in a minimal number of hours in continuing education. In Pennsylvania the State Board of Veterinary Medical Examiners has stipulated that each licensee must attend eight clock hours of educational programs during the twenty-four month period preceding each renewal date. The Continuing Education Program offered by the Veterinary School provides eight hours of credit annually. Approximately twelve courses are offered each year between September and May. Both laboratory and lecture courses are presented, and each course and each course instructor are evaluated by participants, thus helping to improve future programs. The courses cover all species of animals and are presented by members of the Veterinary School faculty or by experts in particular fields from all parts of the country.

Presently the Continuing Education Program is managed by Ms. Ashra Markowitz. Drs. Charles D. Newton, William A. Moyer, and Thomas J. Divers are responsible for developing programs for various courses.

In the Centennial Year, 1984, a special three-day scientific conference featuring an international array of speakers will be held. The program for this will consist of a basic science portion and an applied section. Dr. Robert J. Rutman chairs a committee to develop the basic science sessions of the program.
Research

The exciting and productive research effort generated in the previous two decades continued to grow and mature during this period. The present reputation of the School as one of the world’s great veterinary schools has been built largely upon the scholarly activities of its faculty. The faculty has been uncompromisingly dedicated to research as the primary road to excellence in all of the School’s functions. Particularly, the faculty has been able to fuse the new knowledge generated through research with the teaching program, both in the regular curriculum and in the Continuing Education Program. The broad spectrum of outstanding clinical services offered by the School are largely a product of the research program. Dean Robert R. Marshak has commented that . . . “knowledge growing out of research is the most potent force in determining the nature of veterinary practice . . . .”

The research program in the Veterinary School during the past decade has closely paralleled the great advances made in many biomedical areas, including molecular biology, immunology, electrophysiology, medical genetics and genetic engineering. With increasing frequency, established researchers at other institutions seek out Veterinary School faculty to play key roles in major projects. Also, studies initiated in the School magnetize the interest and participation of top level outside investigators. Some striking examples of this trend are Dr. E. Neil Moore’s work in cardiac electrophysiology, Dr. Benjamin G. Brackett’s research on sperm maturation and in vitro fertilization, the research of Dr. Jorge F. Ferrer’s group in bovine leukemia, Dr. Ralph O. Brinster’s studies on gene transfer, and the contributions of the Section of Medical Genetics headed by Dr. Donald F. Patterson. These, and other individuals at the Veterinary School now occupy positions of international importance in their respective fields of work.

Among all of the world’s veterinary schools none has a stronger commitment to basic science research and comparative medical research than the University of Pennsylvania. The Laboratory of Parasitology has an international reputation for its research in immunoparasitology; the Laboratory of Anatomy has a group of outstanding neuroscientists; and the Laboratory of Biochemistry is noted for its investigations of biochemical phenomena associated with muscle contraction. The School is a pioneer and a continuing leader in comparative medical research. Its contributions cut across many fields, including cardiovascular physiology and disease, nephrology, ophthalmology, dermatology, orthopedics, medical genetics and viral oncology. A particularly noteworthy accomplishment has been the development of animal models for human disease.

The past ten years have witnessed the development of some entirely new fields of research, emphasizing the School’s mission in meeting the increased responsibilities of the veterinary profession. The work in medical genetics represents an entirely new specialty. In addition, studies are underway to generate hard data on various facets of the interrelationships of animals and society, and in the increasingly important field of veterinary economics. Research on the physiology and diseases of marine animals is increasing and the Aquavet Program provides the initial impetus for veterinarians to become involved in this work.
At times the Veterinary School has been criticized for an alleged deficiency of research contributions related to farm animals. The record speaks differently. Today's research at New Bolton Center includes basic and/or applied studies on nutritional, metabolic and digestive diseases of cattle, mastitis, leukemia and other infectious diseases, parasitic diseases, reproductive disorders, feeding behavior, cattle immunobiology, cytogentics, and the development of newer surgical techniques for farm animals. The newly established Animal Health Economics Unit, was created to formulate a new health care delivery system for veterinarians and dairy farmers, and to implement and evaluate preventive medical services. The work of this unit is organized in the form of prospective epidemiological studies that will evaluate a comprehensive array of biological and environmental variables. The studies will enable an assessment of the efficacy of various services, leading to indicated improvements. In the overall area of research on farm animals some excellent collaborative efforts have been developed particularly with Pennsylvania State University, and the New York College of Veterinary Medicine at Cornell University.

Over and above its obvious contributions to the teaching and service functions of the School, research plays a vital role in financial support for the School. A subcommittee of the Long Range Planning Committee, chaired by Dr. Robert J. Rutman, surveyed the overall research effort between the years 1971 to 1978 and produced data to indicate just how important this role is in the budgetary structure of the School. Over these years the total budget for the School amounted to 91.2 million dollars; of this research grants and awards amounted to 30.5 million, or 33.4 percent of the total. When viewed against other major sources of income this figure becomes highly significant; tuition income accounted for 12.3 percent, and monies from the state appropriation represented 15.0 percent of the total budget. An important element in the role played by research funds is the fact that from most research grants the School receives a certain amount of overhead which can be used for unrestricted purposes. Grant funds have enabled the School to remain in a competitive position for faculty recruitment, and have made an important contribution to renovations of the physical plant, the purchase of new equipment for research and teaching, and the development of new programs. In a real sense, many faculty regularly subsidize the teaching program by providing their salaries and salaries of their colleagues through research grants. A major factor in the development of clinical specialties has been the ability of the clinical departments to attract training grants.

The present scope of the research program is illustrated by the fact that, according to Dr. Thomas W. Langfitt, vice president for health affairs in the University, in 1982 the Veterinary School had more research funds (over $6 million) than two-thirds of the medical schools in the United States!

The importance of creating new programs, which in turn generate new sources of funds, is illustrated by the situation in the Section on Medical Genetics. In 1982, this Section had research funds totalling $420,000 in direct costs for research; in addition, the School received $205,000 for use as unrestricted funds.
Research in the Department of Animal Biology

In the Laboratory of Biochemistry, Dr. Samuel K. Chaeko is conducting fundamental research on such problems as contractile proteins in normal and pathologic smooth muscle, the regulation of contraction, and the contribution of arterial wall changes in hypertension. In 1983, Dr. Chaeko was the recipient of a Senior Research Fellowship from the Fogarty International Center of the National Institutes of Health for studies at the University of Tokyo on the biochemical regulation of arterial smooth muscle. The problem of aging is Dr. Vincent J. Cristofalo’s field of research. He has investigated the regulation of cell division and the intermediary metabolism of normal and neoplastic cells. Dr. Robert E. Davies has a long, distinguished career in a number of areas of biochemical research. For the past ten years his work has focused on the mechanism, energetics and thermodynamics of contraction and vigor development in skeletal, cardiac, and smooth muscle in various vertebrates and invertebrates. Dr. Adelaide M. Delluva is also interested in certain biochemical phenomena associated with muscle contraction. She is investigating the energy requirements of skeletal muscle in the process of contraction. In this work she employs radioisotopes to trace some possible energy sources and she is investigating the formation of lactic acid and the conditions governing this formation. Dr. M. Raja Iyengar’s research is concerned with the hormonal regulation of uterine growth, and a study of energy regulation for cardiac function. Dr. David Kritchevsky has done outstanding research in such fields as lipid biochemistry, atherosclerosis, aging and nutrition. Dr. Bernard H. Shapiro has studied the development of controls of sexual differentiation of the reproductive structures, brain and liver. He has determined which hormones irreversibly organize developing tissue as male or female and how, at the molecular level, hormones direct for the differentiation of sexual tissues. Dr. Shapiro’s work has shown that male brains are organized by female sex hormones, and that livers may be masculinized by pituitary hormone(s). Dr. Robert J. Rutman’s work concerns investigation of the mechanism of action of cytotoxic anti-cancer drugs such as cytorex, alkerean, and carmustine. His research includes the development of new procedures for improving the selective uptake of anti-cancer drugs by directed modifications of cellular permeability, using liposomes of varying composition and physical characteristics. Dr. Narayan G. Avadhani has studied the sites of attack on the DNA model by allatoxin, an important and lethal liver toxin which may affect a variety of domestic species. Allatoxin is also an important cancer-causing agent and this property is being used to identify the critical targets on the DNA molecule which are responsible for transforming normal cells into tumor cells and how these new patterns of gene expression are regulated.

In the Laboratory of Pharmacology, Dr. Carl F. Aronson’s major field of research is toxicology. He has studied the toxic effects of thallium and chlorpromazine, and has conducted a number of studies on the effects of drugs on the heart, including disophenol, bunamidine, ketamine, promethazine, and isoproterenol. Dr. David F. Kowalczyk is also interested in toxicology, especially the effects of heavy metals. He has been involved in a study of environmental zinc and cadmium pollution associated with osteochondrosis, osteoporosis, and nephrocalcinosis in horses. Dr. Kowalczyk has also done work on the pharmacokinetics of diphenylhydantoin in horses, and on the correlation of serum levels of diphenylhydantoin after oral and intravenous doses in dogs. Dr. Margit M.K. Nass is involved in investigations on the mechanism of action and effects of selected DNA-binding carcinogens, mutagens, and anticancer agents on nuclear and mitochondrial DNA structure, replication and expression. Dr. Carl A. Ritter has worked diligently for ten years in elucidating the transport process whereby tumor cells take up nitrogen mustard. His work has shown that the carrier system can be stimulated by changing either the plasma membrane, calcium phospholipid composition, or both, leading to an improved carcinostatic effect of nitrogen mustard.
Dr. Ralph Brinster, of the laboratory of physiology, has carved out a distinguished career in research beginning with his earliest studies on the nutrient requirements, metabolism, and control of development of the ova prior to implantation, and leading up to his brilliant work on the transplantation of a rat growth hormone gene into mice. In his early research on embryos Dr. Brinster showed that pyruvate played an essential role in the metabolism and nutrition of the preimplantation embryo, and this was the foundation for the development of culture media used in the embryo transplant work in cattle. Following these studies Dr. Brinster became interested in how differentiation is regulated and he was able to transfer cells from a malignant carcinoma into mice blastocysts which were then allowed to develop in foster mothers. Normally, the cancerous cells injected into adult mice would kill the animals in about three weeks. In Dr. Brinster's work offspring from the treated blastocyst lived and one animal out of sixty showed dark hairs that could only have come from the cancer cells. This research showed that the cancer cells participated in the embryo's development and that the embryo regulated the cancer cells. This work provides a basis for a better understanding of both cancer and normal cell differentiation. In his recent research, Dr. Brinster and colleagues modified the rat growth hormone gene and transplanted it into mice. The mice grew at a rate almost twice as fast as normal. This work demonstrated, for the first time, that genes can be transplanted from one mammalian species to another and can be expressed phenotypically in such a manner as to affect basic metabolic function. This research has some great implications, including the possibility of developing "genetic farming" in which altered genes are utilized to produce protein substances such as clotting factors used for hemophilia. The work may also have application in animal production, introducing the possibility of altering the growth pattern of animals so that they reach the market at an earlier time or that milk production may be significantly increased.

Dr. E. Neil Moore, professor of physiology, and his colleagues, especially Dr. Joseph F. Spear, are continuing research in electrophysiology and electropharmacology. Drs. Moore and Spear have carried out some exquisite work in developing methods to predict which individuals have a high risk of developing arrhythmias. This research has provided the basis for a new endocardial resection technique in humans...
to identify and remove areas of undesirable electrical activity within the ventricles. Dr. Moore’s research has also elucidated the way in which beta blocker drugs act in decreasing the incidence of sudden death in patients. The work of Drs. Moore and Spear is an outstanding example of the vital contributions which the Veterinary School is making in comparative medical research. In recent years, another individual who has become intimately involved in the work is Michael B. Simson, M.D., who is assistant professor of medicine in the Medical School, University of Pennsylvania, and who holds an appointment as assistant professor of physiology in the Veterinary School.

Also in the Laboratories of Physiology, Dr. Richard O. Davies is continuing his basic studies on the role of peripheral and central chemoreceptors in respiration. Particularly, he has been concerned with the brainstem processing of pulmonary mechanoreceptor information. Dr. Davies studies are important in understanding the role of the central nervous system in mediating the reflex effects of stimulating pulmonary mechanoreceptors and irritant receptors, as seen in chronic lung disease, pneumothorax and the inhalation of irritant gases. Dr. Jules Melbin is extending his pioneering investigations of hemodynamics, especially pulmonary blood flow. Dr. Melbin’s unique training in engineering, veterinary medicine and cardiology have enabled him to develop methods for the solution of hemodynamic flow equations. His work involves biological experiments together with computer simulations dealing with the coupling of the heart and vascular system.

Dr. David K. Detweiler, professor of physiology, has continued his life-long interest in clinical and epidemiological factors in canine myopathies. He is currently investigating the hypothesis that canine cardiomyopathies represent an autoimmune response to the myocardium that has been previously damaged by viral myocarditis. Also, in the area of comparative cardiology, Dr. Detweiler is continuing research on clinical and etiological factors in canine hypertension. Another field of investigation involves computer-assisted analysis of Beagle and rat electrocardiograms for toxicological and pharmacological studies. Dr. Detweiler is also studying the electrocardiographic effects of test agents producing chronic cardiotoxicity in experimental Beagles and rats.

Dr. Leon P. Weiss, Grace Lansing Lambert Professor of Cell Biology, is widely regarded as one of the world’s experts on the functional anatomy of the hematopoietic system. The work in his cell biology laboratory is morphological, depending heavily upon electronmicroscopy, autoradiography, tissue culture, histochemistry and cytochemistry and related methods. Much of the research utilizes mutant and inbred strains of mice whose hematopoietic system offers unique advantages for basic investigations of erythropoiesis, anemia, erythrocyte parasitization, lymphocyte function, including antibody formation, splenomegaly and hypersplenism. Some of the research involves the dog, cat, and horse. The equine spleen offers an important model for clarification of the splenic lobule and open circulation, while studies on the equine bone marrow have illuminated the barrier between the vascular and hematopoietic components. An important aspect of the work in his laboratory has been the training of Ph.D. candidates who are looked upon as future leaders in academic veterinary medicine.

The Laboratory of Anatomy is noted for its work in the field of neuroscience which is making important contributions to a better understanding of the complex functions of the central nervous system. Dr. Adrian R. Morrison is an authority on neural regulation of sleep and the ways in which sleep disorders affect respiratory and cardiovascular function. He is also interested in investigating neural pathways of aggression in animals. Dr. Peter J. Hand is using sophisticated mapping techniques to investigate the pathways of somatic sensation, including pain, and Dr. Richard R. Mielke is conducting fundamental research on the neural control of drinking behavior.
and salt and water conservation by the kidney. In 1983, Dr. Miselis was the recipient of a Fogarty International Fellowship and spent seven months at the Flore Institute of Experimental Medicine, Melbourne, Australia, where he continued his studies on water balance in sheep. The work of Dr. Peter Dodson adds an entirely new dimension to the research program of the group in anatomy and serves as a prime example of the diversity and breadth of the research interests of the faculty. Dr. Dodson is associate professor of anatomy, and his research areas is paleontology. He is especially interested in dinosaurs. He has carried out taxonomic studies in the Dinosaur Provincial Park, studies on the sternum of Camptosaurus, and on the quantitative aspects of relative growth and sexual dimorphism in Protoceratops.

Another member of the Laboratory of Anatomy with a discrete research interest is Dr. David S. McDevitt who is investigating the development and regeneration of eye tissues, especially the lens. At present, only certain amphibians have the ability of regenerating lens tissue; Dr. McDevitt is studying the factors involved in this process which has obvious clinical significance for mammals. Lens proteins (crystallins) are being examined in normal developing and regenerated lenses to determine if differential gene expression is involved in regeneration of a lens.

Research in the Department of Pathobiology

The Laboratory of Parasitology is the center for parasitologic studies in the University. Beginning with the arrival of Dr. E.J. Lawson Soulsby in 1964, and continuing under the direction of Drs. Gerhard A. Schad and Robert B. Grieve, the Laboratory has acquired an international reputation for studies in the field of immunoparasitology. The work in this field focuses on host-parasite interactions, especially the antigens parasites produce at various stages of the life cycle. The group in parasitology is also investigating mechanisms controlling host immunologic responses to parasitic infection, and is interested in expanding research in the area of tropical veterinary parasitology. One important potential of research in immunoparasitology is the development of vaccines to prevent infections and the use of immunologic techniques for diagnosis. Recent work by Dr. Robert B. Grieve has demonstrated the great practical importance of this approach. His work has led to an important breakthrough in the diagnosis of canine filariasis, leading to the development of a serological test to detect antibodies produced against antigens of adult heartworms. He is using new techniques to recover antigens from early larval stages and is now investigating the problems of developing a vaccine for heart-
worm infection. The new test is effective in detecting infections with immature worms as well as instances in which adult worms, but no circulating microfilaria, are present. Dr. David Weiner has continued his studies on host-parasite relationships in filarid infections. He has developed a very sensitive antigen-detecting test for *Dirofilaria immitis* and is now attempting to isolate and characterize specific antigens. Dr. Weiner has also investigated the mode of action of diethylcarbamazine against the microfilaria of *Listomosoides carinii*. Dr. E. Lawson Soulsby is a world authority on the immunological aspects of parasitism, and before leaving the faculty in 1978 he carried out a broad program of research in this field. Included in his research were studies on the immunological unresponsiveness of the neonatal ruminant to gastrointestinal parasites, and the epidemiological significance of the acquisition of immunological competence to gastrointestinal strongyles by young ruminants. Dr. Soulsby also investigated the efficacy of some newer anthelmintics in farm animals. Three other individuals who have left the faculty conducted work on the immunobiology of parasites. Dr. Omar O. Barriga studied the immunobiology of *Trichinella spiralis* and Dr. Gene B. Solomon investigated the epidemiology of *Capillaria hepatica* and the detection of antibody in the liver lesions caused by this parasite. Dr. Bert E. Stromberg, Jr., worked on the identification of parasite antigens and on the immune protective response. He was also interested in developing methods for *in vitro* cultivation. Dr. Colin Johnstone is presently engaged in research on the epidemiology of gastrointestinal nematodes in sheep, strongyle infections in horses, and the meningeal worm of Pennsylvania elk. He is also interested in developing new and practical information about economic factors in parasitism of farm animals. Dr. Jay P. Farrel is involved in studies on the immune response to parasitic infections. He is especially interested in visceral leishmaniasis, a condition of public health importance. His work involves tracing the course of metastasis of *Leishmania chagasi* in the dog and correlating levels of infection with clinical, immunologic, hematologic and pathologic alterations during the course of the disease. Dr. Gerhard A. Schad's research has centered on the ecology and epidemiology of helminths and the growth and development of nematodes. He spent seven years on a meticulous study concerning the arrested development of larval hookworms in the host. Dr. Schad has also done work on the epidemiology of trichinosis in Eastern United States.

Dr. Leonard J. Bello, a member of the Laboratory of Microbiology, has devoted a number of years to research on cell cycle control in mammalian cells. He is particularly interested in the role of differential gene function in regulating the rate of cell division and in the alterations in cellular senescence. Dr. Benjamin Wolf, a long-time member of the Laboratory of Microbiology, is involved in the elucidation of the action of latent immunoglobulin genes by Trypanosome infection to study the immune regulation. Dr. Wolf is also doing research on the induction of rheumatoid factors by injecting cartilaginous collagen and studying the immunopathogenic effects in this procedure. Dr. William C. Lawrence is employing sophisticated DNA hybridization techniques to study herpes virus infections in several economically important diseases of domestic animals, including bovine rhinotracheitis, equine rhinopneumonitis, and pseudorabies in pigs. His work is aimed at the detection of latent herpes virus genes in neural tissues of cattle, horses, and pigs and the characterization of immunologically significant components of herpes virus for development of diagnostic tests as well as the creation of vaccines from virus subunits. The appointment of Dr. Charles E. Benson to head the work in microbiology at New Bolton Center has led a considerable increase in research on infectious diseases of farm animals and horses. There are a number of clinical syndromes in these animals which appear to be infectious in nature but for which a causative organism has not been identified. Dr. Benson and various clinicians at New Bolton Center have teamed together to study some of these perplexing syndromes with the goal of establishing etiological agents. Dr. Benson has a particular interest in studying *Salmonella* infections, the cause of great concern among horse owners; he is especially concerned with the isolation of the *Salmonella* enterotoxin gene. Dr. Ben-
son is also conducting research on the pathogenesis of infection due to Legionella pneumophila, the cause of the infamous "Legionnaires Disease", and on the etiology of "shipping fever" in horses and cattle.

Dr. Wesley C. Wilcox, professor of microbiology and head, Laboratory of Microbiology, has had a continuing interest in the study of the genetic expression of certain herpes virus proteins active in eliciting defense mechanisms in the host. Dr. Roselyn J. Eisenberg's research centers on the study of the synthesis, processing and functioning of herpes simplex virus (types 1 and 2) glycoproteins. Presently she is engaged in work to develop a vaccine for herpes.

In the Laboratory of Pathology Dr. Helen M. Acland is involved in studies on equine metritis and swine tuberculosis, both studies being funded by the Pennsylvania Department of Agriculture. Dr. Michael A. Goldschmidt's primary research field is in pathologic dermatology. He has conducted work on bullous pemphigoid, anal sac adenocarcinoma, and tumors of epithelial and adnexal structures in the dog and toxic nodular goiter in the cat. The field of collagen immunology and diseases of connective tissue is the theme of research by Dr. Diane E. Gunson. She has carried out studies on collagen, the reaction of antibodies to basement membrane collagen, immunoglobulin deposition in equine glomeruli and on osteochondrosis in cattle and horses living in the vicinity of a zinc smelter. Before leaving the faculty in 1983, Dr. Richard Dubielzig was engaged in some interesting studies on comparative dental and ophthalmic pathology; some of his work involved a study of the visual apparatus of the Bowhead and Gray whales. Dr. James R. Rooney, who was a full-time faculty member from 1969 to 1977, conducted studies on the biomechanics of equine lameness. Dr. Robert J. Eckroade has studied various poultry diseases and virus diseases of mink. He is presently involved in a study on Newcastle Disease Virus in which an isoelectrofocused antisera for the antigenic analysis of the virus has been developed. Once perfected this technique will be used to compare to the ELISA method for monitoring immunity of chickens to the Newcastle virus. For a number of years, Dr. Wilfried W. Weber has been engaged in exhaustive research on lymphocyte functional capacity and on the immunopathology of cancer. Dr. Wayne H. Riser, who retired in 1980, devoted many years of study in the field of orthopedic pathology, especially hip dysplasia. Dr. John T. McGrath, a pioneer in veterinary neuropathology is working on a project involving the use of tomography in brain abcesses of monkeys and is also preparing a textbook on canine neuropathology in which he will correlate the great amount of case material accumulated over many years in the Hospital.

For a number of years Dr. Alan M. Kelly has conducted basic studies in the general field of muscle development and diseases of this tissue.

Research in the Department of Clinical Studies, Philadelphia

The research effort of this department was greatly enhanced by the opening of the new Veterinary Hospital of the University of Pennsylvania (VHUP) in 1981. The new facility provides laboratory-office suites for the various clinical specialties, an excellent clinical laboratory, custom designed space for animal colonies, and a number of areas with temperature and humidity control and special noise-deadening properties.

The research in the clinical specialties has provided much new information about the control and treatment of disease in companion animals. Particularly noteworthy has been the development of animal models for human disease.

Dr. Kenneth C. Bovee, the Corrine R. and Henry Bower Professor of Medicine and chairman, Department of Clinical Studies, Philadelphia, specializes in nephrology, and is conducting studies on renal tubular defects, renal tubular acidosis, the influence of dietary protein on renal function, and the Fanconi Syndrome. For his work on the Fanconi Syndrome, which has important comparative aspects, he maintains a colony of dogs which are the offspring of animals having the naturally occurring disease in order to study the biochemical and genetic nature of this particular
tubular defect. Dr. Meryl P. Littman, a young member of the medical staff, has begun a study on spontaneous hypertension in the dog with the idea that, if sufficient cases are discovered, this could represent an important resource for the study of the pathogenesis of the condition in man.

Dr. Joan B. O'Brien, professor of medicine, is engaged in a number of studies including the use of laryngology and branch oesophagology in natural disease of animals, an investigation of the anatomy, electromyography and histology of the abnormal and normal larynx, and the use of surgery in achalasia. She is also interested in studying conduction velocity in canine and equine recurrent nerves, and on the effect of long-term tracheotomy in dogs.

Dr. Ann M. Chiapella, who left the faculty in 1980, worked in the field of gastrointestinal function and disease, conducting studies on the effect of fiber on colonic motility, and the effect of feeding on myoelectrical and contractile activity of the canine distal colon.

Dr. Lillian Maggio-Price, who is lecturer in medicine, is investigating some basic mechanisms of erythropoiesis, especially the use of erythroid stem cell cultures to evaluate the hematopoietic stem cell response to various types of anemia.

Before leaving the faculty in 1982, Dr. Peter J. Felsburg, who was assistant professor of clinical laboratory medicine, carried out studies on the immune response to infectious disease agents and tumor antigens, and the development of enzyme-linked immunosorbent assays. Dr. William Medway's research centers on studies of physiological and disease processes in marine animals. He has done blood and urine studies on such animals as dolphins, the California Gray Whales, the Bowhead Whale and the West Indian Manatee. Dr. Wilbur B. Amand's research involves studies of diseases of wild animals, birds and reptiles. He has done work on avian anesthetic agents and techniques of anesthesia, and on paratuberculosis in the Dromedary camel.

In surgery, Dr. Elizabeth A. Stone, chief of the Section of Small Animal Surgery, is conducting a study to correlate the functional and structural renal changes that are seen in bitches with naturally occurring pyometra. Dr. Meryl P. Littman is working with Dr. Stone on this research. Dr. Stone is also doing a collaborative study on thrombosis with investigators from Temple University Hospital, Philadelphia. The research of Dr. Colin E. Harvey, professor of surgery, focuses on the clinical investigation of diseases of the head, neck and chest of dogs and cats, and in particular on the mechanics, control and effects of obstruction of the upper airways, and surgical approaches for its correction.

Dr. Harvey has done studies on neurogenic atrophy of the laryngeal muscles in the dog, surgery for stenotic nares in brachycephalic dogs, and parotid saliva duct rupture in the dog and cat. Dr. Dudley E. Johnston's work includes a clinical investigation of the healing of the urethra in dogs, the treatment of perianal hidradenitis in dogs, the cause and treatment of gastric dilatation/torsion in dogs, and the use of tissue ph in monitoring the systemic effects of trauma. Dr. Gail K. Smith is using his engineering background to develop models to study effects and characteristics of various implants used in orthopedic surgery. Dr. Smith has also carried out some excellent work leading to new methods of repair for rupture of the cruciate ligament in dogs. Dr. Charles D. Newton's general area of work is in orthopedic surgery of small animals, and in particular with arthritis in small animals, and in avian bone repair.

Dr. Alan M. Klide, associate professor of anesthesia, has conducted a number of studies on newer drugs including an investigation of the cardiopulmonary, renal and pathological effects of methoxyflurane anesthesia in the dog, a clinical trial of sulfanilamide in cats, and a study of the cardiopulmonary effects of detamine-acepromazine and ketamine-xylazine in the dog. Presently, Dr. Klide is interested in the fascinating possibilities offered by acupuncture as a therapeutic agent for various conditions in animals. Dr. Barbara E. Penny has done studies on the effect of combinations of various drugs, such as ketamine and xylazine, and morphine and xylazine, on cardiopulmonary function in the dog. She has also investigated the cardiopulmonary effects of apneic oxygenation.

In the Section of Epidemiology, Dr. Lawrence T. Glickman, chief, has conducted some excellent studies that have
provided valuable information on the epidemiology of various diseases and their public health significance. He has studied the prevalence and pathogenesis of *Toxocara*iasis in dogs with special attention on its role in causing ocular disease in children, and with Dr. Victoria Voith has investigated the value of companion animal therapy in a nursing home. Dr. Glickman has also researched the use of clinical criteria as predictors of causative organisms in bovine mastitis, and the relationships of canine viruses to multiple sclerosis. Recently, Dr. Glickman has worked on the epidemiology and breed susceptibility of canine parvovirus infection and on the potential use of epidemiologic studies of spontaneous tumors in pet animals which might provide an insight into the role of environmental factors in human cancers and serve as sentinel models to identify environmental health hazards for humans. Dr. Glickman and his colleagues have recently shown a relationship between the development of mesotheliomas in pet dogs and the exposure of the animal to asbestos.

In the Section of Cardiology, Dr. David H. Knight, chief of this Section, is pursuing work on the pathophysiology of pulmonary hypertension and the development of animal models for this condition. He has developed a canine model for evaluation of antihypertensive and anticholesterolemic agents, and he has done some pioneering investigations of pulmonary hypertension produced by *Dirofilaria immitis*. Dr. James W. Buchanan, who spent about ten years in developing plans for VHUF, is now able to spend more time in pursuing his research interests, which include the pathogenesis of congenital heart disease, and cardiac surgery. Dr. Buchanan is presently working on the problem of the calcification which occurs following cardiovascular prosthesis. This occurs in some children with bioprosthetic heart valves and may require reoperation and replacement of the valves. Dr. Buchanan's group has developed a special device which can be implanted in dogs to test the various hypotheses that have been advanced to explain the development of calcification.

In the Section of Ophthalmology, Dr. Gustavo D. Aguirre has been interested in the electrophysiology and ultrastructure of retinal photoreceptor development and degeneration. Dr. Aguirre has also been involved in the development of animal models of hereditary retinal degeneration and other genetic defects leading to disease of the eye. In the near future Dr. Aguirre will move to Dr. Donald F. Patterson's Section on Medical Genetics in order to intensify his research on genetic problems. Dr. Lionel F. Rubin's main fields of research are diseases of the retina, ocular pathology and toxicology. He has carried out studies on progressive retinal atrophy in Irish Setters, pathogenesis of degenerative pannus, neurofibrillary degeneration in cone dysfunction and on congenital day blindness in dogs.

Dr. Sheldon A. Steinberg, chief of the Section of Neurology, is involved in an ongoing study involving the characterization of spontaneous nerve and muscle diseases in animals. He has done studies on acute idiopathic polyneuropathy in dogs, and methods of evaluating spinal fluid, and choroid plexus tumors in dogs. Dr. Steinberg has also been involved in sleep studies in the cat, and on the effect of Rubella Virus on tumor growth. Dr. George C. Farnbach's research focuses on epilepsy in the dog. He has developed an epilepsy register for dogs, known as the American Canine Epilepsy Service, to formulate an information bank on this condition and to devise more effective dose-schedules for managing seizures with anticonvulsant drugs. This service provides determination for serum levels of anticonvulsant drugs such as phenobarbital, diphenylhydantoin, primidone, ethosuximide, and carbamazepine. Although the service began only in 1982, Dr. Farnbach has already made over 500 serum determinations from clinical cases of epilepsy across the country and has developed new information on dosage for some drugs. Dr. Farnbach is also interested in investigating the use of computerization of electrophysiological techniques in the evaluation of neural and neuromuscular disease on a clinical basis, and is involved in an investigation of the role of sarcolemma in muscular disease and the electrophysiology and immunology of polymyositis.

The primary research interests of the Section of Dermatology, including Drs.
Robert M. Schartzman, chief, William Miller and Vicki Jo Scheidt, are the immunological and allergic aspects of skin disease. The Section has a close relationship with its counterpart in the School of Medicine and is developing animal models for human disease, and at one time maintained a colony of dogs for the study of allergic skin diseases. Before leaving the faculty in 1977 Dr. Richard E.W. Halliwell conducted some excellent studies on hypo-sensitization in atopic dogs.

The Section of Radiology, including Drs. Darryl N. Biery, chief of the Section, W. Harker Rhodes and Jeffrey Wortman, is involved in work designed to enhance imaging through the use of ultrasound, nuclear medicine, computerized tomography, and nuclear magnetic resonance. The group is also involved in ongoing studies of radiation therapy. Dr. Sidney M. Evans, instructor in radiology, is presently engaged in postdoctoral work at Children's Hospital of Philadelphia where she is investigating the response of human melanoma and neuroblastoma cellular tumor spheroids to radiation.

Dr. Ann Jeglum's field of research is oncology. Her laboratory is the only one in the country which is exploring the use of cancer vaccines in dogs and cats. Dr. Jeglum is studying the effect of these vaccines, pioneered at the Frederick Cancer Research Institute, Frederick, Maryland, in activating the body's immune response. Her interest is to determine whether the vaccines may be of value in prolonging remission when they are used following an initial program of chemotherapy.

Dr. Gene Eigenmann is conducting some intriguing research on the relationship between growth hormone levels and the development of diabetes mellitus, acromegaly, and dwarfism in dogs. A major contribution has been the isolation of canine growth hormone and the development of a radioimmuno assay to determine its levels in the dog. Dr. Eigenmann has shown that in elderly female dogs diabetes mellitus often occurs during diestrus when progesterone levels are high. At this time growth hormone and insulin levels are elevated; injection of high doses of progestagens such as medroxyprogesterone acetate (MPA) produce a similar syndrome. Growth hormone is known to inhibit the action of insulin at peripheral sites of glucose utilization. In elderly female dogs with diabetes mellitus, ovariohysterectomy, by reducing progesterone levels, alleviates the condition. Dr. Eigenmann has also established the relationship between high levels of growth hormone and the occurrence of acromegaly, and more recently he has been investigating the role of under-production of growth hormone and growth factors in dwarfism in dogs. Since there appears to be a genetic factor in dwarfism, at least in certain breeds, he is cooperating in studies with Dr. Donald F. Patterson, Chief of the Section of Medical Genetics in the Veterinary School and Dr. E.R. Froesch of the Metabolic Unit, University of Zurich, Switzerland. He is especially interested in studying growth factors in breeds of dogs of different body size.

Section of Medical Genetics

In a real sense, the Section of Medical Genetics grew out of research activities of the Comparative Cardiovascular Studies Unit (CCSU) which flourished during the previous two decades. Dr. Donald Patterson, chief of the Section, became involved in genetics as a result of his early work in the CCSU. He observed that certain heart diseases occurred in a high frequency among certain breeds of dogs and conducted family studies and breeding experiments which established the genetic nature of these disorders. This work led him to engage in further intensive study of genetics at Johns Hopkins University. Afterward he defined and characterized the genetic nature of a number of cardiovascular diseases and with his associates began to study other diseases that were wholly or partly genetic in origin. Thus, a new specialty was born in veterinary medicine, Medical Genetics.

Dr. Patterson is now Charlotte Newton Sheppard Professor of Medicine, and is a world authority on genetic diseases of animals. The Section of Medical Genetics, established in 1973, is the only such unit in any veterinary school anywhere in the world. Dr. Patterson points out that as we obtain better control of infectious, nutritional and parasitic disease, these primarily environmental disorders become less im-
portant as causes of illness and death. At the same time there is an increase in the relative importance of diseases which are primarily genetic in etiology. Today, the practitioner deals with a large number of disorders which are wholly or partly of genetic origin, and evidence is increasing that heredity factors are responsible for a high death rate among newborn offspring of purebreed dogs and cats. The high frequency of some types of cancer and degenerative diseases in older animals is probably due to a genetically determined increase in susceptibility to these conditions. There is also substantial evidence that leukemia and mastitis in cows, parasitism in sheep and leukemia in chickens is genetically determined. All of these factors underline the present and potentially great importance of a unit staffed by highly trained individuals to effectively deal with these problems. Animal models can provide important insights into causes, pathogenesis and therapy of human disease and this is especially true in genetic diseases where the chain of events between the underlying cause and the pathogenic phenotype is difficult or impossible to study in man. Recently the Section has observed a number of new diseases, many of which are counterparts of human diseases, and the characterization of more such interrelationships is on the horizon.

In his early studies in the CCSU, Dr. Patterson observed the high frequency of Tetrology of Fallot in Keeshond dogs. He has established a colony of this breed and through a controlled breeding program has developed an invaluable resource for continuing study of this cardiac malformation, the most common anomaly producing human “blue babies”. Mr. William Schnarr, who began working with the CCSU at its outset, has prepared exquisite models of the canine embryonic heart which are three dimensional and are one-hundred times the original size. These are the most accurate models of the embryonic heart ever made, and this work marks the first time that predictable cardiac malformation has ever been studied at different periods during embryonic development. It now appears that the inheritance pattern, at least in some families, is the same for the human as for the dog.

Dr. Peter F. Jezyk heads up the field of work concerned with inborn errors of metabolism. In addition to his work in the Medical Genetics Section, Dr. Jezyk is in charge of the metabolic screening laboratory at Children’s Hospital of Philadelphia (CHOP). In 1977, through his screening work Dr. Jezyk uncovered the first case of mucopolysaccharide defect in cats. This condition, characterized by a slight decrease in body size, a characteristic facial appearance, and bone and joint problems, has actually been around for some time but the underlying problem was never recognized. After this initial observation by Dr. Jezyk, the condition has been studied in detail by Dr. Mark E. Haskins who defined a specific enzyme defect in these animals, the same defect seen in Maroteaux-Lamy Syndrome in humans. Through some outstanding work Dr. Haskins has now developed a test to detect carriers. Cats are excellent models for a group of disorders known as mucopolysaccharidoses which encompasses a series of diseases in humans, especially in children, who, when affected have a limited life expectancy. In cooperation with Mt. Sinai Hospital, New York City, a colony of cats has been developed in which the disease is inherited as a recessive trait. With this special colony it is possible to investigate basic questions concerning the relationship between the mucopolysaccharidoses and brain function and bone development.
For several years Dr. Jules R. Selden, adjunct assistant professor of medical genetics, has worked on the problem of developing normal standards for banded chromosome preparations. A series of animals with congenital malformation and intersexuality have been screened for chromosome abnormalities and a number of chromosome defects have been identified. This work is being done in cooperation with Dr. Paul Moorhead of the cytogenetics laboratory of CHOP.

Dr. Vicki N. Meyers, a newcomer to the Medical Genetics Section, has been involved in various studies in the unit. Her interest in genetic disorders of the reproductive system led her to apply for, and receive, an NIH Postdoctoral Fellowship under which she will work until 1986.

A major objective of Dr. Patterson's group is to develop biochemical tests which will detect animals who are carriers of genetic defects, but appear normal. This approach would obviate the need to breed animals in order to determine carriers and could be expected to eliminate genetic diseases due to recessive gene mutation from a breed or kennel within a short time.

The laboratory of the Medical Genetics Section can now screen urine for many compounds in the search for metabolic disorders, and has a system in which a special paper is dispensed to practitioners for dipping into urine samples and returned to the laboratory for analysis. By this method a number of new "inborn errors" of metabolism have been discovered.

A great strength of the Medical Genetics Section is its close association to other facilities. Dr. Patterson is a member of the Human Genetics Department in the Medical School of the University of Pennsylvania. The Section of Veterinary Medical Genetics is a part of the University's Genetic Center and its research is partially supported by an NIH Genetic Center Grant, first funded in 1974. Because of the excellent progress made in identifying and studying animal models of human genetic disease, this grant has been renewed for two additional periods, up to 1989. The division of Biochemical Development and Metabolic Diseases at CHOP, headed by Dr. Stan Segal, has been supportive in providing special biochemical analyses. This association has been facilitated by Dr. Jezyk's position as director of the Metabolic Screening Laboratory at CHOP. The Section has also cooperated with the Division of Medical Genetics at Mt. Sinai School of Medicine in New York City, headed by Dr. Robert Desnick, and with Dr. Stephan J. O'Brien of the National Cancer Institutes Section of Genetics.

Center for Interactions of Animals and Society

In 1977 the Center for Interactions of Animals and Society was established in the Veterinary School under the direction of Dr. Alan Beck. This unit which also has teaching and service functions, has conducted studies on the interrelationships of companion animals and society, the use of companion animals in therapy programs for the elderly, and on behavior of animals. This is an interdisciplinary unit whose research involves psychiatrists, psychologists, veterinarians and animal behaviorists. Among others, Dr. Beck has worked closely with Aaron Katcher, M.D., who is associate professor of psychiatry in the Medical School. Also involved in certain studies are Dr. Victoria L. Voith, instructor in medicine and Dr. Eleanor Ryder who holds joint appointments as professor of social work in the Veterinary School and the School of Social Work. Research by the Center includes controlled studies on the...
therapeutic value of companion animals for
the elderly and for patients in mental
hospitals, investigation of the role of horses
in the lives of young people, and studies
on behavioral problems of dogs, cats and
exotic animals. Drs. Beck and Katcher have
carried out work on the role of companion
animals in the recovery of human patients
following major surgery, and heart attacks.
These studies have shown that the presence
of a pet, even fish in a tank, affects physiolog-
ical functions, such as blood pressure.
Animal owners with pets had significantly
improved survival rates following heart at-
tacks, and in an individual petting or
fondling a pet, the blood pressure lowers.

The same effect has been observed in sub-
jects watching fish in a tank. In October
1981, the Center for the Interaction of
Animals and Society hosted an interna-
tional conference on the Human/Compa-
nion Animal Bond. This meeting, attend-
ed by about 500, was the first time that
quantitative data was reported on the
Human/Animal Bond. Included in the pro-
gram were reports on horseback riding
therapy programs, programs using animals
with the aged, animals and the family,
social work practice and veterinary
medicine, evaluation of animal behavior
and nursing practice and the companion
animal.

Research in the Department of
Clinical Studies New Bolton Center

During the period 1973 to 1983 research
in this department provided much new in-
formation about health and disease in farm
animals and horses. Researchers were
especially active in the fields of gastro-
enterology, nutrition and in investigations
of metabolic disorders. The work in the
field of equine orthopedics continued to be
innovative and productive, and studies on
various aspects of parasitism in sheep were
begun. The appointment of Dr. Charles E.
Benson as associate professor of micro-
biology enhanced the research on infectious
diseases while the departure of Dr. G.
Frederick Fregin led to curtailment of
studies on exercise physiology in horses. Dr.
John R. Fetrow has added a new dimension
to the research program with his work on
veterinary economics and the development
of delivery systems for health maintenance
programs. Drs. William J. Donawick and
Eric P. Tulleners are active in developing
new surgical methods applicable to farm
animals. The Georgia and Philip Hofmann
Center for Reproductive Research continues
to carry out a variety of studies on repro-
cutive physiology and disease, and the
Comparative Leukemia Studies Unit,
under Dr. Jorge F. Ferrer has scored some
major breakthroughs in our knowledge
about oncogenic viruses and bovine
leukemia. The construction of two new
buildings improved the facilities for
research. These are the C. Mahlon Kline
Orthopedic and Rehabilitation Center and
the George D. Widener Hospital for large
Animals.

Dr. Robert H. Whitlock, professor of
medicine and chief, Medical Services at
New Bolton Center carries on a very active
research program. His major area of work
is the study of gastroenterologic disorders
of food producing animals and horses, and
his research has included investigations of
abomasal displacement in cattle, dietary ef-
ficacy of colistin sulfate in treating col-
bacillosis in calves, and an evaluation of
the use of oral electrolytes in calves. Dr.
Whitlock has also conducted studies on
Swine Tuberculosis, and Equine
Salmonellosis. Until he left the faculty, in
1978, Dr. Alfred Meritt's primary interest
was gastrointestinal physiology. Among
other work he investigated the control of
porcine gastric secretion and the patho-
physiology of equine diarrhea. Dr. William
J. Donawick, the Mark Whittier and Lila
Griswold Allam Professor of Surgery, who
did some pioneering work on interspecies
heart transplant, has more recently been in-
volved in research on the metabolic care of
the horse with acute abdomen and the ab-
sorption and secretion of water and elec-
trolytes by normal and obstructed bowel of
the horse. Dr. Donawick and his colleagues
are also engaged in the development of newer surgical techniques for farm animals. These are techniques which the practitioner can adapt for use in the field. Dr. David E. Freeman is interested in the absorption and secretion of amino acids by the equine cecal and colonic mucosa, and on the absorption of nonelectrolytes by the equine small intestine. He has also done studies on the effect of fasting on intestinal absorption in equines, and on laryngoplasty in the horse.

Dr. David Nunamaker, the Jacques Jenny Professor of Orthopedic Surgery, is continuing the tradition of excellence established by Dr. Jacques Jenny in orthopedic research. In the Biomechanics Laboratory at New Bolton Center, located in the C. Mahlon Kline Center for Orthopedics and Rehabilitation, he is conducting some outstanding work on fatigue fractures of the horse metacarpus, the design and development of external skeletal fixation in equines, and bone stress analysis. He has also done studies on surgical arthrodesis of the fetlock joint in the horse, and on the strength of healing fractures in the dog with, and without, internal fixation. Before leaving the Faculty in 1981, Dr. Gustave E. Fackelman was involved in work on internal fixation of fractures, transplantation of tendons and skin, and lymphography. Dr. Dean W. Richardson is presently involved in a study of synovial fluid composition during the development of degenerative joint disease. Dr. James A. Orsini is investigating the value of selective neuronal destruction as an alternative to neuroectomy for the relief of chronic pain. He has also conducted evaluations of newer drugs, and has been involved in research on external skeletal fixation in horses, the acid-base status and renal function in cattle, and the prognostic uses of nutritional indices in horses.

Dr. Lawrence R. Soma's primary fields of research are anesthesiology, pulmonary function, analgesia and clinical pharmacology. He has investigated the problem of exercise-induced pulmonary hemorrhage in the horse, and he has studied lung water volume of the horse at rest, and at exercise. Dr. Soma's work has also included investigation of phenylbutazone kinetics and metabolite concentrations in the horse, neuroleptanalgesia produced by fentanyl and droperidol, and in collaboration with Dr. Diane E. Gunson, renal papillary necrosis with phenylbutazone after water deprivation in the horse. Dr. Lin V. Klein, a member of Dr. Soma's Section of Anesthesia, is interested in the intriguing problem of anesthetic-induced myopathy in the horse, and has also done a study of electromyographic responses to nerve stimulation in horses forage poisoning. Dr. Jill Beech has been involved in studies on allergic respiratory disease in the horse, and on allergen skin testing and immunotherapy in horses. She has also conducted research on the pharmacokinetics of diphenylhydantoin on neuroaxonal dystrophy in the horse.

Dr. Richard A. McFeely's research for the past twenty years has involved chromosome studies in domestic mammals. He is especially interested in chromosomal anomalies that affect reproductive performance either by producing developmental abnormalities of the reproductive system or by increasing embryonic and fetal wastage as a result of genetic imbalance. Most recently he has been investigating techniques for sexing embryos used in bovine embryo transfer operations.

Dr. Robert J. Eckroade, director of the Poultry Diagnostic Laboratory, is involved
in developing an automated serological test system (ELISA) to monitor antibody levels in poultry, and in studying the epornithology of recurring *Clostridium botulinum* intoxication in chickens.

Dr. David S. Kronfeld’s group in nutrition has done some outstanding research on metabolic disorders associated with pregnancy, parturition, lactation and exhaustive exercise, on nutritional requirements of animals under varying conditions, and on the pharmacological control of feeding behavior. Dr. Kronfeld has been involved in research on ketosis, calcium metabolism and vitamin A in cattle, fat metabolism of dairy cows, major metabolic determinants of milk volume, lactational efficiency and spontaneous ketosis in dairy cows, and the metabolic effects of feeding protected tallow to dairy cows. He has also conducted work on the inherited predisposition of dogs to diet-induced hypercholesterolemia, the reduction in hemodynamics in uremic dogs fed reduced protein diets, and on diets which promote maximal performance in horses and dogs. Dr. William V. Chalupa has done some very fine research on the chemical control of rumen microbial metabolism. This has included investigations on the use of buffers for dairy cattle in early lactation, the action and use of sodium and potassium bicarbonates in dairy cattle, amino acid degradation by pure cultures of rumen bacteria, and the effect of the introduction of urea on feeding behavior in cattle. Before leaving the faculty in 1983, Dr. Clifton A. Baile did some basic studies on the pharmacological control of feeding behavior and especially on the role of cholecystokinin; Dr. Mary Ann DelaFera contributed significantly to studies on the role of cholecystokinin in satiety of sheep. One of Dr. Baile’s major interests is the development of cheaper diets which will allow beef cattle to grow at an optimal rate. For example, he has shown that the use of certain chemicals to increase hunger will induce cattle to eat straw. Dr. Charles F. Ramberg, Jr., who has worked at New Bolton Center since 1968, has conducted a variety of metabolic studies having important clinical applications in farm animals. These have included an investigation of dietary calcium, calcium kinetics and plasma parathyroid hormone concentration in cows, kinetic analysis of calcium metabolism in the cow, and kinetic analysis of calcium transport across the placenta. Dr. Ramberg has also worked with zinc absorption kinetics following intraruminal and intra-abdominal zinc administration in sheep and kinetic analysis of zinc homeostasis in zinc-treated sheep. Dr. Susan Donoghue, a newer member of the Section of Nutrition, is doing research on fat soluble vitamins, the nutrition of the fetus and neonate, and on the relationship of parasitism in sheep to nutritional requirements. An important feature of the research by those in the Section of Nutrition has been the collaborative efforts between individuals in the Section and with investigators in other disciplines.

Dr. Thomas J. Divers, a relative newcomer to the staff, has been involved in a number of studies, including investigations of acute renal failure in horses due to hemodynamic, toxic and immunologic causes, toxic hepatic failure in neonatal foals, nephrolithiasis in horses, and studies on hematuria of renal origin in horses.

Dr. John P. Fetrow has used his unique educational background, in veterinary medicine and business, to conduct studies in the increasingly important field of veterinary economics including the development of economic models of preventative medical and management programs. Through computer technology, Dr. Fetrow conducts cost/benefit and cost/effectiveness analyses of programs for treatment and health maintenance programs and has developed record systems for on-farm microcomputer record systems.

Dr. Elaine P. Hammel has had a long time interest in equine exertional myopathies and the general field of exercise physiology and muscle metabolism and disease. Recently she has been involved in a study on hematological and metabolic responses to exhaustive exercise in sled dogs fed various diets.
Dr. Jorge F. Ferrer, professor of microbiology, in Clinical Studies; chief, Section of Viral Oncology; director, Comparative Leukemia Studies Unit.

Comparative Leukemia Studies Unit

This Unit is a part of the Department of Clinical Studies, New Bolton Center.

The research project on bovine leukemia (leukosis, lymphosarcoma), which has now spanned nearly twenty-five years, began with the study of a few herds of dairy cattle in which confirmed cases of the disease had occurred. Some small grants were obtained to support these studies which were expanded to include other herds in 1962.

In 1964 a large grant was received from the National Institutes of Health to purchase a herd of Jersey cattle, then located in Virginia, which had a high incidence of leukemia. This herd, designated as the BF herd, was moved to New Bolton Center and housed in a leased barn on an adjacent property. In 1965, a large grant enabled the construction of laboratory and office facilities, three holding barns and auxiliary buildings at New Bolton Center. When these structures became available the scope of research was enlarged to include studies on transmission, transplantation, and etiological factors of the disease. In the meantime, the number of herds studied in the field increased and an intensive study of the BF herd was taking place. Dr. Robert M. Marshall was director of the work which in its early stages was carried out in cooperation with the South Jersey Medical Research Foundation, Camden, New Jersey.

Some key personnel who became involved in the work in the 1960s were Drs. Donald Abt, Douglas C.D. Hare, David Dodd, Ray M. Dutcher, and Edward P. Larkin. The field studies, including blood sampling, physical examinations, and obtaining pedigree information were conducted by Drs. Henry Kulp, J. Ellis Crowshaw, Jack Switzer, and John E. Martin, and Mr. Robert Pollock. Mr. Ronald Zuka was in charge of laboratory hematological work.

These early studies, which extended through the 1960s, contributed much valuable information leading to a better understanding of hematological, hereditary and epidemiological aspects of the disease, and built-up a stock of information which was of great value in later studies.

The field studies grew from a few herds in 1959 to forty-five herds in 1964. By 1968, a total of sixty-seven herds had been studied. These were dairy herds in the Eastern United States, from Vermont to North Carolina. After preliminary information was obtained on a herd it was assigned to one of three major categories; (1) Leukemia free or "normal"; (2) multiple case; and (3) contact, or herds in which leukemia had never been diagnosed but in which animals coming from herds known to have the disease had been introduced.

The work involved blood sampling, pedigree information, and herd health surveys. The blood samples were used primarily to investigate the occurrence and significance of persistent lymphocytosis as a possible diagnostic and prognostic tool. In 1964 approximately 4,000 animals were sampled, resulting in a total of 19,000 blood specimens obtained since the studies originated. The herds included Jersey, Holstein, Ayrshire, Guernsey, and Brown Swiss breeds. By 1970 a total of 86,000 hemograms were on file, and at this time it was possible to state that the absolute lymphocyte count was not a valid indicator of the presence or absence of the disease.

Information about the genetic aspects of bovine leukemia was obtained from field studies, and especially from an intensive analysis of the BF herd, including a carefully controlled breeding program. The information obtained soon indicated that bovine leukemia occurs in striking familial aggregations. This was especially apparent in the BF herd. This herd first came to the
attention of investigators when it was found
that nineteen cases of leukemia had oc­
curred in these animals. Further studies revealed
that there was a well defined genetic
pool in the herd which appeared to have
an important bearing on the subsequent oc­
currence of leukemia; the disease occurred
only in animals with a marked concentra­
tion of blood lines tracing back to a com­
mon pool, consisting of one cow and two
bulls. This had been a closed herd since
1935 in terms of the female population;
some breeding bulls had been purchased
or borrowed. All of these facts indicated the
extremely great value of this herd as a cen­
tral resource for leukemia research, and
when funds became available from the Na­
tional Institutes of Health it was purchased.

Almost certainly, the BF herd represents
a resource for leukemia research that is un­
paralleled anywhere else in the world. Since
its purchase the herd has been under in­
tensive investigation in terms of genetic
background, hematologic and clinical con­
figurations, and has been used for virolo­
gical, and immunological studies. Large
amounts of semen and many serum
samples have been harvested from BF
animals and stored. The herd has acted as
a source of animals and biological materials
for investigators at other institutions.

Through a careful program of selective
breeding and culling the herd has been
continuously improved as a research
resource. The breeding program has enabl­
ed investigators to concentrate family blood
lines derived from each of the three major
connections to the foundation pool and at
the same time, to produce sufficient
number of replacement animals with
minimal leukemia blood lines so as to ade­
quately maintain unaffected families in the
herd. After location of the herd at New
Bolton Center, it soon became possible for
researchers to determine the relative risk
of leukemia of each BF animal. This feature
has made the BF herd an exceptional
animal population for studies on the pathogenesis of leukemia in a species that,
like man, is relatively outbred. Moreover,
because of its predictable attack rate of
leukemia, the BF herd is exceptionally well
suited for immunoprophylactic studies.

By 1981, seventy-six confirmed cases of
leukemia had occurred in the BF herd. By
this time 340 animals had been raised to
a sufficient age to be considered at a risk
for leukemia. These data are illustrative of
the extremely high incidence of leukemia
in this group of cattle. By 1981 routine
sampling had been carried out on 434
animals and a total of 19,962 hemograms
were on file.

During the 1960s a variety of research
was conducted in an attempt to elucidate
the etiological agent of bovine leukemia
and to investigate such matters as natural
and experimental transmission, transplan­
tation, cytogenetics, and cytologic and
ultrastructural examination of tissue
cultures from affected animals. The search
for a viral agent was under the direction
of Dr. Ray M. Dutcher, who through elec­
tron microscopy demonstrated a few struc­
tures resembling C-type virus particles in
milk of cattle in the high incidence BF
herd.

Dr. William C.D. Hare and associates
found that about two thirds of the cases of
bovine leukemia have chromosomal abnor­
malities and that these changes differ from
case to case. These investigators also ob­
tained cytogenetic data indicating that the
disease is unicentric in origin, and
established a number of permanent
cultures of bovine leukemic cells (cell lines
NBC) that have the same chromosomal ab­
normalities as those found in the neoplastic
cells of tumor masses of the donor animals.

Initial electronmicroscopic examinations
of the NBC cell lines and other tissues of
affected cattle and attempts to transmit or
transplant the disease, failed to reveal the

Comparative Leukemia Studies Unit, New Bolton Center.
then suspected etiological agent. However, the NBC cell lines provided information that became useful in later research.

Another important finding made during the first phase of the bovine leukemia program was that two out of six chimpanzees fed raw milk from the BF herd developed erythroleukemia. This finding was made in a collaborative study with the Yerkes Primate Institute, and was initiated before the discovery of the bovine leukemia virus. Subsequent studies showed that the BF cows that served as donors of the milk fed to the chimpanzees were infected with the virus, thus raising a concern that cows milk may contain a virus potentially leukemogenic for man.

In the early 1970s, new priorities were established for the research, and an intense and coordinated attack was begun on finding and characterizing the causative agent of bovine leukemia. When this approach began in the Section of Viral Oncology of the Comparative Leukemia Studies Unit there was a decrease in field study activity, and this was gradually phased-out. Two of the field study herds are still available as sources of particular research material when this is needed. At the same time there was a decrease in the intense hematological studies on the BF herd and a gradual decrease in herd size. However, careful herd records and a controlled breeding program have been maintained.

The record of research accomplishments from 1970 to the present is outstanding. Much of the credit for this belongs to Dr. Jorge Ferrer, for his own personal contributions and to the guidance he has given to his research team. Dr. Ferrer has headed the Section of Viral Oncology since 1969 and the Comparative Leukemia Studies Unit since 1974. During this second phase of the bovine leukemia program, Drs. Robert R. Marshak and Donald A. Abt have continued to lend support to some aspects of it.

Major accomplishments during the past decade can be summarized as follows: Through detailed electronmicroscopic studies it was established that the virus-like particles seen previously by other workers in short term cultures of bovine leukocytes do indeed correspond to a virus. These data, together with the results of electronmicroscopic studies on long-term cultures of bovine leukemic cells, established conclusively the existence of a bovine C-type virus, that is a virus belonging to the same group to which the leukemia viruses of other species belong. The availability of the study herds, particularly the BF herd, that had been characterized in detail during the first phase of the program, enabled Dr. Ferrer's group to show that the occurrence of leukemia in cattle is closely associated with the presence of the bovine C-type virus. These findings, and results of transmission studies, demonstrated that the virus is the causative agent of leukemia in cattle. Accordingly, this agent was termed the bovine leukemia virus, or BLV. The seroepidemiological surveys in the study herds showed that BLV is also closely associated with, and probably the cause of persistent lymphocytosis, a condition whose nature had been a controversial subject for many years. Data obtained in the Comparative Leukemia Studies Unit indicated that persistent lymphocytosis is not a subclinical form of bovine leukemia, as was previously believed, but rather, an essentially benign, genetically-determined response to BLV infection.

Following the establishment of the only available well-characterized monolayer cell culture that produces BLV consistently and abundantly, and is free of adventitious agents, Dr. Ferrer and his associates defined the main properties of BLV and developed several specific and sensitive detection assays for the virus. They also developed, standardized, and critically evaluated several serological tests for the identification of BLV-infected cattle. These various techniques have played a pivotal role in studies on the biology and pathogenesis of BLV. Furthermore, the availability of sensitive and reliable serological diagnostic tests have made it possible to conduct extensive surveys which have shown that BLV is widely disseminated in the cattle population of the United States and many other countries. Researchers in the Comparative Leukemia Studies Unit have also identified modes of spread of BLV in cattle, thus making it possible to delineate the main principles for control and eradication of BLV infection and bovine leukemia.

The research of Dr. Ferrer's group has established a number of other facets of new
knowledge on the etiology and pathogenesis of bovine leukemia. These include the demonstration that although BLV belongs to the C-type retrovirus group, it differs from all the known members of this group in several important, immunological, genetic, biochemical, and biological properties. Based upon data of the first studies showing these differences, Dr. Ferrer suggested, during the 1970s, that BLV may be the prototype of a family of as yet uncharacterized leukemia viruses, and that this family could conceivably include the then suspected human leukemia virus. This possibility has gained strong support after HTLV—a C-type retrovirus recently isolated from human T-cell leukemias was found to be uniquely related to BLV.

Researchers in the Comparative Leukemia Studies Unit also described the main features of the virus-host interactions in the BLV system and several special characteristics of the expression of BLV. The results of their investigations have contradicted the central postulates of the "oncogene hypothesis" which was the most pervasive force in the field of viral oncology during the 1970s. This hypothesis proposed that leukemia and other forms of cancers arise as the consequence of the activation of endogenous, genetically transmitted C-type retroviruses, that are present in all vertebrates. It also proposed that, as the result of exposure during embryonic life, the hosts of these endogenous viruses become immunologically tolerant to their major core antigens. The group in the Comparative Leukemia Studies Unit showed that, in contrast to the predictions made by the oncogene hypothesis, BLV is transmitted mainly by contact, is exogenous to the bovine species, and does not induce immunological tolerance in cattle. As a result of these and similar findings in other systems, it is now widely accepted that most, if not all, the C-type retroviruses responsible for naturally occurring cancers in mammals are exogenous, and spread mainly in a horizontal fashion. Thus, the studies on the BLV system contributed by Dr. Ferrer's group have contributed essentially to dispel dogmas that during almost a decade had polarized and misdirected the bulk of the research activities in viral oncology.

Dr. Ferrer's group also showed for the first time that BLV infection in cattle and sheep is always persistent despite the fact that all infected animals continuously have antiviral antibodies, often in high titers. Through extensive, long-term longitudinal studies it became apparent that the large majority of the BLV-infected cattle never develop leukemia, and are asymptomatic carriers. Other investigations by this group showed that whether a BLV-infected animal develops leukemia or remains as a healthy virus carrier depends mainly upon its genetic constitution.

Another important aspect of the BLV system that was described by researchers in the Comparative Leukemia Studies Unit concerns the peculiar characteristic expression of BLV in cattle. It was found that, in contrast to the C-type leukemia viruses of mice and cats, BLV is usually present in its host in a repressed state and that this repression occurs at the transcriptional level. These findings not only have been essential for understanding the biology of BLV infection in cattle, but also have established the BLV system as a unique model for studies on the expression of covert leukemia viruses, and for the development of approaches to uncover such viruses in other species, including man.

According to recent studies by Dr. Ferrer and his associate, Dr. Phalguni Gupta, the transcriptional repression of the BLV genome in the animal is mediated by a protein that is not an antibody or an interferon molecule, and that is present in the plasma of virtually all BLV-infected cattle. These findings have no precedence in any other viral system and represent a new important contribution in the field of viral oncology. Their significance in comparative leukemia research is emphasized by the fact that, as in the case of BLV, the expression of the only known human leukemia virus (HTLV)
is under the control of a plasma factor that is similar to the factor that controls the expression of BLV.

In summary, researchers at the Section of Viral Oncology have described the main characteristics of a system that has proven to be one of the most relevant models for studying the etiology, pathogenesis, and immunoprophylaxis of viral-induced leukemias in man. Also, through the development of reliable and sensitive detection assays and the elucidation of the main modes of transmission of BLV, they have provided the basis for rational and effective eradication and control programs of BLV infection and leukemia in cattle, problems of growing importance for the livestock industry. Finally, Dr. Ferrer's group has generated important new information regarding the potential public health significance of BLV by showing that most BLV-infected cows release the virus in the milk in an infectious form, and that BLV can readily infect human cells in culture.

Investigators in the Comparative Leukemia Studies Unit are now attempting to develop a vaccine against BLV using, among others, DNA recombinant techniques. Other major research goals of Dr. Ferrer's group include the elucidation of the mechanisms of BLV leukemogenesis at the host, cellular, and molecular levels, and a thorough investigation of the question of whether or not BLV is infectious for humans.
This magnificent facility, dedicated on May 15, 1981, sets the world standard for health care for animals. It incorporates the most advanced biomedical equipment and technology, and provides a near perfect setting for the integration of teaching, research and patient care. The Hospital was built at a cost of about 16.5 million dollars and was fully functional by the fall of 1981. It has a staff of over seventy veterinarians, most of whom engage in research as well as providing clinical service and teaching. The four story building provides in-patient care for 250 animals of the small domestic or feral species. It is designed to ensure maximal comfort and safety for animal patients. Veterinary students educated and trained in VHUP graduate with an inspiring image of small animal practice and with a sensitive appreciation for nature and the importance of the human-animal bond.

VHUP stands on a plot of ground at Thirty-ninth and Pine streets, once the site of a convent whose buildings were later used as the home of the School of Allied Medical Professions (SAMP) of the University of Pennsylvania. The architect for VHUP was Vincent Kling of Philadelphia, and construction was financed primarily through $2.3 million in private contributions, including $1.3 million from the Mabel Pew Myrin Trust, a five million dollar grant from the federal government, and a long-term loan of eight million dollars from the Commonwealth of Pennsylvania. Initial planning for the Hospital was begun in 1971 and specific details were developed beginning in 1975 by a Hospital Building Committee chaired by Dr. James W. Buchanan. The completed structure reflects the efforts of many individuals, but primarily the commitment of Dr. Buchanan who subjugated his personal interests in research and teaching to attend to even the most minute details in making VHUP an extraordinarily functional teaching hospital. Dr. Buchanan visited a number of veterinary hospitals in the United States and Europe in order to incorporate the best of their features and to profit by past mistakes. The School is indebted to him.

VHUP is a four story building containing over 150,000 square feet of space, and is connected to the quadrangle building through two second story walkways which bridge what was Thirty-ninth street. Patient receiving, the Emergency Service, and examining rooms, radiology and cardiology services occupy most of the first floor. The waiting room space provides special sections for dogs, cats and exotic animals. There are nineteen examining rooms and the radiology unit features special rooms for cardiac catheterization, tomography and ultrasound and an anesthesia and recovery room. The Emergency Service, which has a separate entrance, is equipped for such emergency procedures as cardiac resuscitation, minor surgery, and poison control.

The second floor of VHUP houses office-laboratory suites for such specialties as gastroenterology, dermatology, nephrology and oncology, a cage cleaning facility, a quarantine area, and, as is the case throughout the hospital, lounges and conference rooms. The third floor contains in-patient wards, an orthopedic treatment room, neurology laboratory, six operating rooms, an anesthesia laboratory and surgical preparation room, an intensive care unit, a respiratory unit laboratory, an ophthalmology laboratory, a nursing station, and a central pharmacy.

The fourth floor of the Hospital provides a diagnostic laboratory, a Medical Genetics Section, and units for studies in reproduction, clinical immunology, epidemiology and endocrinology. The basement of the building has necropsy facilities, a student lounge and locker area, and a classroom with 180 seats and modern facilities for audio-visual instruction.

VHUP offers a variety of clinical services including the following: behavior clinic, cardiology, dental clinic, dermatology, exotic animal clinic, medical genetics, pediatrics and reproduction, nephrology, endocrinology, hematology, respiratory disease clinic, neurology, oncology, ophthalmology, orthopedics, radiology, and soft tissue surgery. The Hospital provides the services of a social worker, Mr. Jamie Quackenbush, who is available for consultation with clients. In addition to the diagnostic laboratory, VHUP is supported by other laboratories in the Veterinary School, including pharmacology and toxicology, virology, parasitology, microbiology, and pathology. VHUP has an excellent working relationship with the Hospital of the University of Pennsylvania (HUP), Childrens Hospital of Philadelphia.
(CHOP) and other medical and biological facilities within and without the University. This association greatly expands the special diagnostic and treatment procedures offered by VHUP. A wildlife clinic is available; this is staffed by students, on a voluntary basis, under the direction of Dr. William Medway. In 1983 a new service was inaugurated to diagnose and treat inherited diseases of the eye. This service, headed by Dr. Gustavo D. Aguirre, is part of the Section of Medical Genetics. In addition to diagnosis and treatment the service will advise dog breeders about the elimination of inherited problems through selective breeding.

The total clinical load of VHUP is now in excess of 19,000 cases annually. About one-third are cases referred by private practitioners, and another 6,000 cases originate in the Emergency Service which is operated
on a twenty-four hour basis. The Hospital
has developed a carefully conceived re-
feral system for communicating with prac-
titioners.
In 1982, visits to VHUP comprised the
following numbers of cases: Canine, 15,065;
feline, 3,142; avian, 401; snakes/reptiles, 125;
rodents, 58; primates, 7; mustelides
(Skunks, ferrets), 89; and rabbits, 69.
VHUP, being a large and sophisticated
Teaching hospital, is expensive to operate.
The fact that there is no third-party pay-
ment plan means that most of the expense
of operating the facility must derive from
direct charges to clients. Annual operating
costs for VHUP, including utilities and
maintenance, are approximately $700,000.
Under the able administration of Barry J.
Supine, associate dean for administration,
and his staff the Hospital recovers approxi-
mately 90 percent of its operating cost in
client fees — a remarkable figure.

George D. Widener
Hospital For Large Animals

In May, 1980 a major addition to the
hospital at New Bolton Center was com-
pleted. This was made possible through a
grant from the estate of Mr. George D.
Widener. Mr. Widener, a famous horseman,
was a member of an old and prominent
Philadelphia family. Mr. Fitzhugh Eugene
Dixon, a nephew of Mr. Widener, was
primarily instrumental in making the funds
available.
The addition to the original Large
Animal Hospital provides an additional
11,430 square feet of space, including a
classroom, known as the Woerner
Auditorium, an Equine Out-patient Clinic,
and offices.
The George D. Widener Hospital for
Large Animals, which is a teaching hospital,
provides complete medical and surgical
facilities for farm animals and horses. It is
supported by a diagnostic laboratory,
pathology and microbiology laboratories,
radiology unit, reproduction clinic, and a
necropsy facility. The C. Mahlon Kline
Center for Orthopedics and Rehabilitation
provides special facilities for orthopedic
surgery and rehabilitation therapy. When
necessary, clinical specialists from the
Philadelphia Campus are available to see
cases at New Bolton Center.
The Equine Outpatient Clinic, headed by
Dr. William A. Moyer, has proved very at-
tractive for horseowners who are often
spared the expense of admitting their

animal to the hospital for treatment pro-
blems that can be handled on an ambu-
latory basis. During 1982 this clinic saw
603 cases.
The majority of cases hospitalized at the
George D. Widener Hospital for Large
Animals are horses. In 1982 a total of 3,865
equine cases were seen at the Hospital, and
of these 901 were surgical cases while 792
were treated by the medical section. Dur-
ing the same period 186 bovines were
treated in the medical section and 392 re-
quired surgery. A smaller number of other
farm animals were also entered in the
Hospital.

George D. Widener Hospital, New Bolton Center.
Nutritional Service

Through its Section on Nutrition New Bolton Center provides a nutritional service to farmers and horse owners. This service, begun in December, 1982, is presently headed by Dr. David T. Galligan, and has the basic function of utilizing nutritional science to tailor feed rations for livestock farms served by New Bolton Center. Dr. Galligan visits farms where he obtains a complete herd history and discusses feeding practices. Samples of forage are obtained and analyzed for nutritional content in the laboratory. The information obtained is compared to National Research Council nutritional standards and a feeding formula is developed for the individual farm. Dr. Galligan visits client farms four times yearly to follow up his recommendations and to make necessary adjustments in the feeding program. While the service is relatively new it has been possible to reduce feed costs on many dairy farms by as much as 15 to 20 percent while at the same time increasing milk production by as much as 13 percent. The service is also available to dog breeders and large kennels.