

Bellwether

University of Pennsylvania

Summer 1997

40

Dr. Deubler's Birthday

The first weekend in May is always an important one in the dog show world — it's the Bucks County show weekend, the



largest outdoor dog show in country, chaired by Dr. M. Josephine Deubler, V'38. Exhibitors come from the four corners of the country to show their dogs at this important event. The Friday before the show seemed the proper day to honor Dr. Deubler, to celebrate her birthday and the



establishment of the Josephine Deubler Genetic Disease Testing Laboratory at the School.

Alumni, faculty and

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From The Dean



I am pleased to say that this has been a very good year for the school as we move ahead in a number of critical areas. Let me focus on just three of these:

In October we opened the

Marshak Dairy, a magnificent new facility at New Bolton Center designed for 200 milking cows. This state-of-the-art facility with its solar design and highly efficient milking parlor has literally changed the face of New Bolton Center while attracting a great deal of attention from producer groups in the State and beyond. By August we will have 160 cows in milk and expect to complete the founding herd in the fall. The facility is designed as a commercial dairy and will enhance our teaching program in production medicine and our ability to assist the dairy industry in Pennsylvania and the nation.

November brought word that our most distinguished scientist, Dr. Ralph

Brinster, had won the Bower Award. This is the most prestigious prize ever won by a faculty in a veterinary school in the world; we are immensely proud of Ralph's accomplishment. The importance of the award is reflected by the fact that it is the largest monetary prize in science in the United States. The award recognizes Ralph's many contributions in developmental and molecular biology and especially his pioneering work on animal transgenesis.

I am very pleased that Dr. Brinster has now taken on the responsibility of Senior Scientist with the Center for Germ Cell Biology and Animal Transgenesis at New Bolton Center. This is a new initiative at New Bolton Center with the goal of applying molecular techniques to improve the productivity and disease resistance of farm animals. Lab renovations for the Center will begin in the fall and should be completed by this time next year.

In February, Governor Ridge announced his proposed budget for 1997-1998 including the welcome recommendation that the State appropriation for the School be increased to \$30.5 million. The Governor's proposal was warmly received

and supported by an overwhelming majority of legislators on both sides of the aisle in the House and Senate and was signed into law in early May. This increase represents a twofold increase in our appropriation since 1994 and permits us to address the School's most pressing needs. These include the provision of scholarships to offset our high cost of tuition for all Pennsylvania residents and renovations of roads and buildings at New Bolton Center. Many buildings at NBC, including the student dormitory, were constructed in the early 1960's and are now in desperate need of repair.

It will take several years to restore the physical plant at New Bolton Center even at our enhanced level of funding from the Commonwealth. Nevertheless, I am immensely grateful to the Governor and all of you who have loyally supported us so we can begin to take care of these critical problems. Now our challenge is to sustain the present level of funding in the years to come. 🐾

Alan M. Kelly,
B.V.Sc., M.R.C.V.S., Ph.D.
The Gilbert S. Kahn Dean of Veterinary Medicine

Dr. Brinster Honored

Dr. Ralph Brinster, Richard King Mellon Professor of Reproductive Physiology, was honored during a ceremony at the Franklin Institute on May 1. He was awarded The Bower Award and Prize for Achievement in Science, the richest American prize in science. Dr. Brinster was cited

"For his groundbreaking contributions to the development of methods to transfer foreign genes into animals and the use of these methods to understand the activity and function of genes. His pioneering work in developing conditions to culture and modify mouse embryos in the laboratory has had a revolutionary impact on contemporary biomedical research, with potential applications in such diverse areas as the treatment of human disease, basic research in cell biology and biochemistry, and the improvement of livestock. His unique contributions to the growing field of biotechnology, arising from a life-long fascination with animals, and his leadership in veterinary education reflect the scientific and humanitarian genius of Benjamin Franklin."



Dr. Ralph Brinster, recipient of the Bower Award and Prize, is shown here, l. to r., with former deans Dr. Robert Marshak, Dr. Mark Allam, Associate Dean for Administration, Barry Stupine, and Dr. Alan M. Kelly, The Gilbert S. Kahn Dean of Veterinary Medicine.

New Bolton Center at the American Gold Cup

New Bolton Center will be beneficiary of the 1997 AMERICAN GOLD CUP, a world-class Grand Prix event, to be held September 11 to 14 at the Devon Horse Show Grounds in Devon, PA.

The AMERICAN GOLD CUP attracts the finest riders in the country who will compete for \$150,000 in prize money. The four-day event includes an International Jumper Futurity, Intermediate Jumpers, Open Speed and Ladies Hunter Side-Saddle competitions as well as the \$16,000 Amateur/Owner Jumper competition, the \$25,000 Welcome Stake, a World Cup Qualifier, and the \$60,000 American Gold Cup.

Saturday, September 13, will be dedicated to Dr. and Mrs. Mark W. Allam. Dr. Allam is Dean Emeritus of the School and primary mover behind the development of New Bolton Center. That evening a champagne reception and buffet will be held, with the proceeds of the event donated to New Bolton Center. Tickets are \$100 per person and reservations can be made by sending a check, payable to the Trustees of the University

of Pennsylvania, to New Bolton Center, University of Pennsylvania School of Veterinary Medicine, 382 West Street Road, Kennett Square, PA 19348-1692; attn.: Ms. Catherine Larmore.

The Celebrity Dog Show also will be held that day at the show grounds. It will be judged by Dr. M. Josephine Deubler. There are no pre-entries, dogs can be entered that day. A children's art show will be part of the day's activities. Free admission is offered to each child under 12 if he/she brings a drawing or painting of a pet. These pieces will be exhibited and judged in the art show. The School's M.A.S.H. tent will be in place for injured, stuffed animals brought in by young owners. Treatments and surgical repairs will be performed by veterinary students, nurses, residents and interns.

New Bolton Center and the Veterinary Hospital of the University of Pennsylvania (VHUP) will be featured in an exhibit highlighting the activities of each hospital. The School's Bloodmobile and the Equine Ambulance will be on view. Numerous shops and food concessions on the grounds

will be open throughout the four days.

Box seats are available at \$300 for a box of six seats, including parking for one car for each day.

Boxes of four seats in the South Stand are available at \$200, including parking for one car each day. Individual reserved seats can be ordered by calling 610-964-9316. The prices follow: tickets for all four days are \$35 each; individual reserved seats for each day are available also, the prices are \$5 for Thursday, \$10 for Friday and Saturday, and \$20 for Sunday, the day of the AMERICAN GOLD CUP competition. A limited number of box seats are available and can be ordered by sending a check, made out to the Trustees of the University of Pennsylvania, to New Bolton Center, University of Pennsylvania School of Veterinary Medicine, 382 West Street Road, Kennett Square, PA 19348-1692; attn.: Ms. Catherine Larmore.

We hope that many alumni and Friends of the School will attend the AMERICAN GOLD CUP. It promises to be an exciting four days, with lots of fun activities for children on Saturday. 🐾

Avian Influenza

Avian Influenza (AI) is a respiratory disease of many species of domestic and wild birds. Historically, in commercial poultry flocks, turkeys are most commonly affected due to the practice of range rearing and comingling, with wild birds. Only six outbreaks of AI have occurred in chickens in the United States prior to the current 1997 epornitic. The 1983-1984 AI outbreak in Pennsylvania resulted in the depopulation of 17 million birds with a cost to the federal government of \$60 million. In the beginning of the outbreak (April - October 1983) there were twenty-five cases of AI. The virus which was isolated from infected poultry was an H5N2 serotype and was classified as having "low pathogenicity." In late October 1983, the virus changed and mortality in commercial flocks approached 90%. The virus was now considered "highly pathogenic." The source of the virus was never determined, but wild waterfowl were considered the most likely source.

Pennsylvania, along with other states in the Northeast, experienced another epornitic

of H5N2 AI in early 1986. This virus was also classified as having "low pathogenicity." The source of the virus was traced to the live bird market system. This system is composed of growers, dealers, wholesalers and retail markets who sell individual live birds for consumption. The method of spread of the AI virus during this outbreak was believed to be related to movement of personnel and dirty crates.

Control measures have been instituted to reduce the spread of AI virus in the live bird system, but despite these efforts AI virus continues to be present. The type of virus which is now circulating in the system is "non-pathogenic" H7N2. This virus, like the H5 serotype of AI virus, has the potential of changing to a "highly pathogenic" form.

In December 1996, there was a trace back from the AI surveillance program in the New York market system to a dealer's flock in Lebanon County. The birds were diagnosed with AI (H7N2) and were depopulated. Subsequent to that, a flock of commercial layers in the same vicinity was

diagnosed with AI in Lancaster County. A total of 10 layer flocks have been diagnosed with AI ("non-pathogenic") and over a million birds have been depopulated in an effort to eradicate this disease outbreak.

The Laboratory of Avian Medicine and Pathology at New Bolton Center, under the direction of Dr. Robert J. Eckroade, has been instrumental in the diagnosis and control effort during the outbreak. Laboratory personnel have had extensive experience in the early detection and identification of AI. They have been working closely with industry and state and federal officials on a daily basis. Currently, about 900 blood and 150 virus isolation samples are submitted to the laboratory on a weekly basis.

The following are the laboratory personnel who have spent numerous hours in control effort for AI in Pennsylvania: Dr. Sherrill Davidson, Dr. Andre Ziegler, Ms. Kimberly Sprout, Ms. Diana Santillo, Ms. Susan Casavant, Mr. Crescencio Gutierrez and Ms. Alice Mark. 🐾

—Dr. Sherrill Davidson

Dr. Deubler's Birthday (continued from cover)

Josephine Deubler Genetic Disease Testing Laboratory at the School.

Christine Connelly, Wayne Ferguson, Walter Goodman and Gilbert Kahn, AKC President Alfred Cheauré and AKC Vice President Dennis Sprung, Westminster K.C. President Chester Collier, and VMAS President Dr. Suzanne Smith were among the many guests who gathered on the evening of May 2 at the Black Bass Hotel in Lumberville to celebrate Josephine's 80th birthday and to wish her many happy returns. It was a grand evening, the weather was fine, the food was great, and everyone enjoyed the terrace and the beautiful view of the Delaware.

There were many tributes to Josephine, from her colleagues, her friends, and her family. The speeches were nostalgic and witty and there was a lot of laughter. Mr. Gilbert Kahn had prepared a wonderful surprise for Dr.

Deubler and the School in the form of a \$100,000 gift to the Josephine Deubler Genetic Disease Testing Laboratory. Dean Kelly and his family had made a rocking chair for her, though whether it will find much use right now is debatable as Dr. Deubler is as busy as ever with her work at the School and her chairmanship of the Montgomery and Bucks County shows. Dr. Kelly also presented her with the School's Bellwether medal, honoring her for her devotion and dedication to Penn's School of Veterinary Medicine.

The dean gratefully acknowledged Mr. Kahn's generous gift and the gifts of many of Dr. Deubler's friends and colleagues. He was most pleased to report that two thirds of the funds needed to complete the \$500,000 goal for the Josephine Deubler Genetic Disease Testing laboratory had been raised as of the birthday celebration and that the laboratory could begin operations later in the year. 🐾🐾



The following have contributed or pledged to the Josephine Deubler Genetic Disease Testing Laboratory:

Animal Rescue League of Philadelphia
 Mr. Nigel Aubrey-Jones
 Ms. Susan Barrett
 Mrs. Patricia Billhardt
 Mr. Carl Blaine
 Ms. Helen W. Brann
 Mr. and Mrs. Lawrence Brown
 Bucks County Kennel Club
 Ms. K. Carol Carlson
 Mrs. Elizabeth Clark
 Ms. Ruth L. Cooper
 Betsy Dayrell-Hart, V.M.D.
 M. Josephine Deubler, V.M.D.
 Ms. Melissa Erickson
 Ms. Maralyn Feige
 Mr. Wayne Ferguson
 Mrs. Muriel Freeman
 Mr. Richard Gebhardt
 Mr. Walter Goodman
 Mr. Gilbert S. Kahn
 Kal Kan Foods, Inc.
 Mr. Kenneth Kauffman
 Mrs. William L. Kendrick
 Kennel Club of Philadelphia
 Mr. and Mrs. F. F. Kipp
 Ms. Patricia W. Laurans
 Ms. Jan Lichtenberger
 Miss Jean S. Madsen
 Mrs. Gwynne G. McDevitt
 Mr. Howard Mershon
 Mrs. Barbara Miller
 Montgomery County Kennel Club
 Mr. and Mrs. C. H. Musson
 Mr. and Mrs. David Nelson
 Dr. William R. Newman
 Dr. William A. Nusser
 Mr. William F. Patter
 Samuel M. Peacock, Jr., M.D.
 Pedigree®
 Ms. Joan Pettit
 Mr. William C. Prentiss
 Doris Gates Rankin, Esq.
 Ms. Mary Remer
 Mrs. Margaret Young Renihan
 Hardie Scott, Esq.
 Mrs. Kate Jennings Seemann
 Mrs. Helen B. Shelley
 Marilyn Simpson Trust
 Dr. and Mrs. Sheldon A. Steinberg
 Dr. and Mrs. Robert W. Stewart
 Mr. William F. Stifel
 Mr. and Mrs. Judson L. Streicher
 Mr. Barry Stupine
 Ms. Francis Sunseri
 Mrs. Helma Weeks
 Mrs. Dorothy L. Welsh
 Ms. Ida Ellen Weinstock
 Mr. Charles S. Wolf
 Mrs. Edith Young
list incomplete at time of printing

Josephine Deubler Genetic Disease Testing Laboratory

The University of Pennsylvania School of Veterinary Medicine has established the Josephine Deubler Genetic Disease Testing Laboratory. The laboratory is part of a service that encompasses a genetic testing and counseling program in the School's Section of Medical Genetics. It is named after the School's first female graduate, Dr. Josephine Deubler, V'38, who served on the faculty until 1987 and is still active in School affairs. The laboratory will be operational in October.

Hereditary diseases of companion animals are an important problem for breeders and owners. More than 350 inherited disorders have been identified in the dog and over 150 in the cat. The Section of Medical Genetics at the School has been in the forefront of reporting hereditary diseases in companion animals for more than 20 years. Many diseases were first discovered by Penn researchers who often also characterized the disease course, determined the mode of inheritance and developed tests to identify affected animals. Since most of the diseases are recessively inherited, tests to identify

carriers who are clinically asymptomatic but can pass on the abnormal (mutant) gene have been developed. With recent advances in molecular genetic technology several DNA-based tests which are more accurate have been introduced.

Now this expertise will be available to breeders and owners of companion animals through the Josephine Deubler Genetic Disease Testing Laboratory. Some examples of the available tests are listed below:

DNA, biochemical and immunologic tests

DNA tests

- phosphofructokinase deficiency • pyruvate kinase deficiency • severe combined immunodeficiency • globoid cell leukodystrophy • mucopolysaccharidosis • glycogenosis

Blood tests-blood typing

- erythrocyte assay • immune function tests • hemostatic tests

Urine tests

- cystinuria • mucopolysaccharidosis • Fanconi syndrome

The genetic testing laboratory is enhanced by a weekly Pediatrics and Genetics Clinic at the Veterinary Hospital of the University of Pennsylvania (VHUP) and the Canine Genetic Disease Information System (to be expanded to cats) to provide counseling and advice on the management of affected animals and on breeding companion animals free of genetic disease. The program will also allow for the investigation of the prevalence of certain genetic diseases and will aid in the identification of new hereditary diseases.

The Genetic Testing and Counseling Program will become a reliable resource at an affordable rate. It is a non-profit operation under the auspices of the University of Pennsylvania School of Veterinary Medicine, supported by donations and modest service fees.

The establishment of The Josephine Deubler Genetic Disease Testing Laboratory has been made possible by the generosity of many donors. 🙌🙌



Portraits of Veterinary Medicine

About two years ago the communications office at the School received a call from Lee Gutkind, a Pittsburgh writer. "I am an immersion journalist and writing a book about veterinary medicine," he said. "I want to present a true picture of veterinary medicine today, describe the day-to-day duties and dilemmas clinicians encounter and show the diversity that exists in the field." Mr. Gutkind visited the School many times, followed clinicians around, saw them on the farms, in the operating rooms, in the intensive care units and in clinics. He visited private practices, zoo practices and talked to many people in the profession.

The result is *An Unspoken Art*, a realistic portrait of veterinary medicine today and a very readable, interesting book, published by Henry Holt and Co. The book explores why those profiled chose veterinary medicine as a profession and talks about the daily challenges facing the veterinarian. It is also about the tremendous compassion and caring Lee Gutkind observed everywhere he visited. It is a "must read" book for anyone interested in the profession. It should be of particular interest to the alumni of the School, to the recent graduates for the portraits of some of their teachers and to the older alumni for the changes it portrays. People who are contemplating veterinary medicine as a career should also read this book. It gives a very realistic picture of today's veterinarian, a person with great compassion in a field with many professional options to pursue a specific area of interest. The book is available for \$25 at your bookseller. 📖

Special gifts

An anonymous alumnus pledged a gift of \$600,000 to support the renovation of student housing at New Bolton Center.

Mr. Jack McCrane made a gift of \$100,000 in honor of his wife, Margrit, to the Humanitarian Fund, an endowment fund established at VHUP to assist needy clients in providing veterinary care for their animals.

1997 Penn Annual Conference

Many thanks to the 750 veterinarians who attended the 1997 PENN ANNUAL CONFERENCE. We are very grateful for the constant support of our alumni, they make this conference a success year-in and year-out. Mark your calendar for the 1998 Penn Annual Conference dates: Wednesday, January 28 and Thursday, January 29 at the Adams Mark Hotel in Philadelphia.

Dr. Charles Newton presented plaques to sponsors and patrons:



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TRANSCRIPTS

To request a transcript from the University of Pennsylvania School of Veterinary Medicine, please:

1. Address: Ashra Markowitz
University of PA, Sch. Vet. Med.
Student and Curricular Affairs
3800 Spruce Street
Philadelphia, PA 19104
2. Cost: \$4.00 per transcript — payable to Trustees, University of Pennsylvania
3. Please allow one week for your request to arrive — and one week for arrival at the institution receiving the transcript.

4. ALL TRANSCRIPTS ARE MAILED ON THE DAY THEY ARE RECEIVED BY THE SCHOOL. WRITTEN CONFIRMATION OF TRANSCRIPT REQUESTS ARE MAILED BY THE SCHOOL. WE DO NOT EXPRESS MAIL TRANSCRIPTS.

University of Pennsylvania School of Veterinary Medicine travels to Turkana, Kenya

This past November Dr. Abby Maxon Sage and fourth year student Ernest Scott Weber V'97 traveled to Kenya to conduct research for the African Medical Research and Education Foundation (AMREF) working with Dr. Timothy Wachira and Eberhard Zeyhle. Using ultrasound to establish the prevalence of hydatid disease in livestock, they spent two weeks working outside Nairobi in the town of Kiserian and another two weeks doing field research in Turkana.

The Turkana is found in northwest Kenya on the volatile Sudan border, and is both the country's largest district and most sparsely populated area. The Turkana people are nomadic, raising



camels, sheep, goats and cattle for their livelihood. This region also has the world's highest number of reported human cases for hydatid disease because of the lack of proper sanitation and education. The AMREF hydatid project has spanned over a decade.

Hydatid disease is caused by the dog tapeworm *Echinococcus granulosus*. Only in the family *canidae* can adult tapeworms mature to produce fertile eggs that pass through the feces. Few clinical signs are seen in dogs. Livestock become infected by grazing on land contaminated by dog feces. In livestock the tapeworms cause cysts, which develop primarily in the liver and lungs. Although mature worms cannot produce fertile eggs in livestock, dogs are reinfected when they eat infected offal of slaughtered goats, sheep, cattle, or camels. Infective dog feces are also responsible for causing the disease in people. AMREF has been responsible for deworming dogs and using ultrasound for human diagnosis of hydatid disease. AMREF has also developed the PAIR method for dealing with

multiple cysts in humans that includes ultrasound guided puncture, aspiration, inspiration, and re-aspiration.

Dr. Sage and Scott Weber evaluated the use of diagnostic ultrasound as a mass screening technique for the detection of hydatid cysts in the liver and right lung of sheep and goats. Three hundred animals were examined using ultrasound and then followed through slaughter to compare *post mortem* findings. This work continues research previously conducted by Dr. Sage and Amanda Fine V'97 in 1995.

After completing the work in Nairobi the team prepared to drive to the Turkana. The only road to Turkana was roughly graded and had few service stations. The last outpost of civilization was the town of Lodwar rising out of the arid land. All the roads were covered in sand drifting from all directions. Several sandstorms made the visibility next to none. A drum of petrol was needed for the remainder of the journey. The next hundred miles were the longest of the journey. Desert stretched on both sides of the road. The trip was plagued with automotive problems from two flat tires to problems with the




condenser, points, and plugs. After piecing together the land rover and having used both spare tires, a third flat tire occurred while rolling into base camp some three hours after anticipated arrival.

Field work in this region included using diagnostic ultrasound to attempt to screen camels and donkeys for the detection of hydatid cysts. The ultrasound technician from AMREF also examined people for hydatid disease. Scott Weber accompanied the technician to help ultrasound people at

a refugee camp for two days. Two publications are anticipated for this last and most recent venture into the Turkana using ultrasound diagnosis in livestock.

This research was made possible from the University of Pennsylvania International Programs fund. The research conducted overseas in these less fortunate areas emphasize the need to share expertise, now taken for

granted in the United States, to better the quality of life abroad. Hopefully the University of Pennsylvania School of Veterinary Medicine will continue to encourage and support faculty and student involvement in International Veterinary Medicine.  —Scott Weber

Dr. Scott Weber was awarded The Thouron Award. He is the first veterinary student to receive this award. It was established and is entirely supported by gifts from Sir John Thouron and the late Esther du Pont, Lady Thouron, of Unionville, PA, as an academic exchange and experience to foster better understanding and closer friendship between the people of the United Kingdom and the United States. The exchange program is set up to bring young people of exceptional ability from each country into contact with the ideas and peoples of another country. In the 30 years of its existence the Thouron Award has played an influential role in shaping the lives and careers



Shown here, l to r, are Dr. Willi Weichelt, V'64, Dr. Scott Weber, V'97, Jane Whitehouse Thouron, Seija Weichelt, Susan Kelly and Dean Alan Kelly.

of alumni. Dr. Weber will be studying for two years at the Royal Dick College of Veterinary Medicine at the University of Edinburgh and at the Center of Tropical Medicine there as well.

Alumni Weekend 1997

New Bolton Center was once again the site of another busy and successful Alumni Weekend on May 17 and 18.

New this year to the weekend's activities was the First Alumni Golf Tournament for alumni, family and faculty! Recognition and thanks for organizing this successful event which took place at Loch Nairn Golf Club in Kennett Square, PA goes to three alumni: Jack Bregman, V'66, Eric Bregman, V'95 and Steve Syken, V'86. The golfers began their complimentary day of golf enjoying a full breakfast under a tent at the edge of the course. Foursomes then set out for 18 holes, culminating in prizes at the end of the day. A portion of the tournament was underwritten by Purina Pet Foods. Next year the dynamic team of Bregman, Bregman and Syken will organize the Second Alumni Golf Tournament for Saturday, May 16, 1998. Mark your date book!

The Dean's Reception on Saturday evening at the Allam House, New Bolton Center was a huge success. Over 100 alumni and their guests attended the cocktail party overflowing the patio onto the lawns, overlooking the pastures and paddocks of New Bolton Center. Alumni came from as far away as California and Florida, many attending their class dinners after the reception at local hotels and restaurants to celebrate their reunion years.

Sunday, May 18 dawned with overcast skies and the threat of rain, but that didn't deter over 300 alumni and their families from attending the Alumni Day barbecue lunch and festivities. The day started with a Veterinary Alumni Society meeting to which all alumni are invited. At that time the Class of 1947 received certificates honoring their 50th Reunion year. Additionally, three Alumni Awards of Merit and the Bellwether Award were presented. At 12:30 p.m. the sun burst forth and an afternoon of food, music and entertainment for young and old alike began. The tours of New Bolton Center and the Marshak Dairy were very popular pastimes.

Next year the Alumni Day luncheon will be held on Sunday, May 17, 1998. The reunion classes will be all those years that end in the numbers 3 or 8 — 1958, 1963 etc..



Dr. Michael Ramer, V'59, Dr. Jack Bregman, V'66, and Dr. Robert Stewart waiting to begin a round of golf.



The Class of 1952 with Dr. Allam. L to R: Dr. Jack Whitehead, Dr. Calvin Moon, former Dean Dr. Mark Allam, V'32, Dr. Fred Guenther, Dr. Don Siffon, Dr. Bob Barndt, Dr. Frank Bartus, Dr. Paul Coogan.

Future veterinary alumni enjoying Alumni Day!





Over 300 alumni, friends and family enjoy lunch under the tent at New Bolton Center on Alumni Day.



Dr. Max J. Herman, V'59, president of the Pennsylvania Veterinary Medical Historical Society, presents a plaque to Dr. Robert Shomer, V'34, in recognition of the donation of Dr. Shomer's library on veterinary history to the Pennsylvania Veterinary Medical Historical Society and the School. The large collection will be housed at New Bolton Center.



Tours of the Marshak Dairy were a big hit.

New Alumni Directory

The School of Veterinary Medicine has contracted with the Bernard Harris Publishing Company to publish a new Alumni Directory. The current Directory was published in 1993. The 1998 version will contain additional information never before included such as undergraduate education, and spouse and children's names to name just a few.

To help make this a useful and effective source of School and alumni information, please fill out the forms when you receive them from Harris Publishing. If you have misplaced your form or never received it, you can call the Alumni Office (215) 898-1481 and request another. See you on the pages of the directory in the Spring!

A foursome of recent graduates enjoys the tournament breakfast.



Alumni Awards of Merit

Each year at the Alumni Day General Meeting of the Veterinary Medical Alumni Society, members of the alumni are awarded the Alumni Award of Merit. The Award is presented to alumni who:

Advance knowledge in biomedicine, promote welfare of animals through public education of animal owners, and benefit society through civic activities which foster the advancement of the profession and the School's good name.

We congratulate the following three alumni who are the recipients of this year's awards.

Glenn J. Lawhon, Jr., V'47

For your outstanding career distinguished by dedicated service to the veterinary medical profession and your community at large.

For your longstanding dedication to veterinary medicine through your active involvement as President of the South Carolina



Dr. Lawhon

Association of Veterinarians, President of the North Carolina Academy of Small Animal Medicine, and President of the South Carolina

Academy of Small Animal Medicine.

For your civic, educational and professional awards that promote the good name of your alma mater, among them Hartsville, South Carolina Citizen of the Year, Clemson University Alumni Distinguished Service Award and South Carolina Veterinarian of the Year.

For your service to your community and country as Mayor of Hartsville, South Carolina and as a Captain in the Army Veterinary Corps.

Edwin Andrews, V'67

For your illustrious career in academia, research and industry, and for the advancement of veterinary education and medicine. For your longstanding commitment and dedication to the School of Veterinary Medicine in your role as former Dean.

For your commitment to sharing your prodigious scholarly contributions with students and colleagues as Professor of Pathology.

For your numerous honors that advance the good name of your alma mater, among

them Who's Who in America, Who's Who in Science and Engineering, American Men and Women of Science, Pennsylvania Veterinary Medical Association Distinguished Veterinary Service Award, and the Dedication of the Edwin J. Andrews Center for Student Life at the School of Veterinary Medicine.

For your active involvement in professional and civic activities including Member of the Board of Trustees of the Philadelphia Zoological Society, Member of the Board of Directors of



Dr. Andrews

the American Society for the Prevention of Cruelty to Animals, and Chairman of the University of Pennsylvania and Montgomery County United Way Campaigns.

Catherine Carnevale, V'72

For your extensive contributions in the field of public health as the Director of the Food and Drug Administration's Office of International and Constituent Operations, Center for Food Safety and Applied Nutrition.

For your commitment to the international



Chair of the Nominating Committee, Dr. Steven Syken, V'86, presents the Alumni Award of Merit to Dr. Catherine Carnevale, V'72.

community on behalf of the Food and Drug Administration in negotiations with the World Trade Organization Sanitary and Phytosanitary (SPS) Committee, NAFTA SPS Committee, GATT Uruguay Round and Committees of the Codex Alimentarius.

For your receipt of numerous honors that advance the good name of your alma mater, among them the Food and Drug Administration's Commendable Service Award for chairing the White House Committee on food safety research, the Environmental Protection Agency's Bronze Medal for Central America projects to control pesticide residues in food, and the Ronald H. Brown Award for conducting the foods training program under the U.S. - Israel Science and Technology Commission.

Veterinary Medical Alumni Society President's Message

Dear Colleagues:

As another group of newly-minted veterinarians leaves the School, so too does the Alumni Society President. It has been a very interesting year and I have become acquainted with some outstanding new and future alumni. I believe Penn continues to attract the best and brightest students and I anticipate great contributions to the profession and society by our fellow new alumni!

I must recognize the work of Dean Alan M. Kelly, Mr. Barry Stupine and their staffs in securing an increase in state funds for the School's budget. In this era of diminishing state resources, the budget increase for the School is a remarkable accomplishment.

The School's tuition continues to be problematic for our students and may deter many highly gifted people from attending Penn. In response to this condition, the Alumni Society Executive Board voted to use all gifts to Alumni Annual Giving for

students scholarship, unless otherwise designated by the donor. By decreasing the tuition burden of our student body we are investing in our own future as well. Who will purchase the practices we have built and nurtured, if our young alumni are paying back \$100,000 worth of loans?

I urge *all* alumni to get involved if not by donating to Alumni Annual Giving, then by serving on the Alumni Society's Executive Board, the Liaison Review Committee or mentoring a veterinary student. It is never too late to make a contribution of time or money to your school.

Thank you for allowing me the privilege of serving as your President. Best wishes to all present and future Penn Alumni.

Sincerely yours,

Carol D. Swandby, V'84



Some members of the Class of 1962 at the Alumni Cocktail party. L to R: Dr. Joseph St. Clair, Dr. Elizabeth Schultz, Dr. Clyde Johnson, Dr. Richard Rodgers, Dr. Harris Mosher, Dr. Ellis Rubin, Dr. James Reid, Dr. A. Gary Lavin.



Class of 1951 Reunion Dinner. L to R, first row: Dr. Loy Ackerman, Dr. John Patt, Dr. Frank Bartus, Dr. Robert Schwarzman, Dr. Fred Guenther. Second row: Dr. Robert Barndt, Dr. Donald Siffin, Dr. Victor Longoria. Third row: Dr. Sidney Flaxman, Dr. John Wilkins, Dr. Arthur Coogan, Dr. John Whitehead.




In line to tee off.

The Bellwether Award



On Sunday, May 17 at the General Meeting of the Veterinary Medical Alumni Society, Dean Alan M. Kelly awarded Dr. Norbert McManus, V'47, the School of Veterinary Medicine's Bellwether Medal on the occasion of his 50th Reunion. The Bellwether medal recognizes and thanks individuals who, over time, have demonstrated an extraordinary devotion and commitment to the School. The medal may be presented to alumni or non-alumni.

Norbert McManus was recognized for his truly tireless efforts as a dedicated alumnus on behalf of the Veterinary School. He has been an active and effective Class Agent for the Class of 1947 for many years, keeping his classmates informed about School activities through numerous newsletters. He motivates his class to some of the highest participation rates in Veterinary Alumni Annual Giving. Norbert is a long term member of the Benjamin Franklin Society and a previous winner of an Alumni Award of Merit in 1986. Both he and his wife, Mary, regularly attend alumni activities and in recent years he personally organized a raffle at Alumni Day, providing all of the prizes. When the School of Veterinary Medicine needed support with the Commonwealth, Norbert wrote numerous powerful and effective letters to key government officials. Professionally, Norbert served a distinguished career in the Armed Service, and is an active member of the Carlisle, PA community.

The entire School of Veterinary Medicine community applauds Dr. Norbert McManus for his 50 years of solid devotion to the School. We are fortunate to call him one of our own. 



Dr. Carol Swandby, V'84, passes the gavel and Veterinary Medical Alumni Society presidency to Dr. Suzanne Smith, V'82, at Alumni Day.



Doris Markle, Dr. Howard Markle, V'47, Dr. Howard Markle, Jr., V'80 and Melanie Markle.



*Lucille and Elizabeth Bollens,
Dr. Kenneth Bollens, Jr., V'72,
and Dr. W. Southard Jones, V'71.*



Dr. and Mrs. Russell Edmonds, V'37.



Class of 1947. L to R, first row: Dr. Robert R. Monahan, Dr. Norbert R. McManus, Dr. Glenn J. Lawhon, Jr. Second row: Dr. Robert Schwarzman, Dr. Howard E. Markle, Dean Alan M. Kelly, Dr. Jules Silver, Dr. Lloyd B. Kornblatt, Dr. Everett E. Denlinger, Dr. Martin A. Bree, Dr. Robert C. Flaherty, Dr. Charles E. Gundlach.

Planned Giving Programs for the School of Veterinary Medicine

Over the years, the School of Veterinary Medicine has received generous support from donors who have made planned gifts through the Planned Giving Programs of the University of Pennsylvania.

Planned gifts are flexible, tax-advantaged arrangements that enable donors to make substantial gifts in ways that complement their personal financial planning. They can be designed to generate life-long income, obtain significant income tax deductions and reduce or eliminate estate taxes. Planned gifts can also be a means of converting low-yielding assets into a higher income stream at a reduced capital gains cost.

The Office of Planned Giving Programs of the University of Pennsylvania offers a variety of life income arrangements including: Charitable Remainder Trusts and Charitable Lead Trusts. The Office of Planned Giving Programs can also help donors tailor bequests and structure gifts of life insurance and other assets for the benefit of the School of Veterinary Medicine.

Participation in any of Penn's Planned Giving Programs also bestows the benefits of membership in The Charles Custis Harrison Society. Those benefits include annual luncheons, seminars and the University's planned giving newsletter, *Partner's in Penn's Future*.

The Office of Planned Giving Programs is always willing to meet with donors and their financial advisors to design the most advantageous ways of giving to the School of Veterinary Medicine. For more information, please contact the Office of Planned Giving Programs at 1-800-223-8236.

Alumni Award of Merit

Call for Nominations

University of Pennsylvania
School of Veterinary Medicine
Alumni Award of Merit

Tell us about a Penn Vet of whom you are proud...

Award Guidelines

The Alumni Award of Merit is awarded each year to three University of Pennsylvania School of Veterinary Medicine alumni celebrating a reunion, whether in practice, academia, industry, research, government service or any other professional area, who:

Advance knowledge in biomedicine, promote welfare of animals through public education of animal owners, and benefit society through civic activities which foster the advancement of the profession and the School's good name.

Selection Criteria

1. The nominee must be a University of Pennsylvania School of Veterinary Medicine graduate.
2. Nominations shall be submitted in writing to the Alumni Office prior to January 15th, 1998.
3. The Nominating Committee will assemble and review information pertaining to the nominee's achievements/contributions to the profession.
4. The awards shall be presented during the Veterinary Medical Alumni Society's general meeting in May.

Nomination Form

For the 1998 Alumni Award of Merit, I nominate: (**please print**)

Name _____ Graduation year _____

Address _____

My reasons for making this nomination are (**resume required**):

Name _____

Signature _____

Address _____ Phone _____

Please return form to University of Pennsylvania School of Veterinary Medicine, c/o Eugenia Warnock, Development Office, 3800 Spruce Street, Philadelphia, PA 19104. **Deadline - January 15, 1998.**

Commencement

Commencement Exercises for the Class of 1997 were held on May 19 at the Zellerbach Theatre at Annenberg Center on campus. The class of 84 women 33 men is the largest to graduate from the School, bringing the total number of Penn Veterinary graduates to 5,326: 1,455 women and 3,871 men. It was a festive and cheerful event and the

auditorium was filled to capacity with members of the students' families.

The commencement address was delivered by John A. Shaddock, D.V.M., Ph.D., former dean, College of Veterinary Medicine, Texas A&M University, executive vice president, operations, Heska Corporation, Ft. Collins, CO.

Dean Kelly presented the diplomas,

assisted by Drs. Richard O. Davies, Urs Giger and Charles D. Newton. Dr. Patricia Sertich assisted the dean with the awarding of prizes. Dr. Suzanne Smith, V'82, president of the Veterinary Medical Alumni Society, presented the Class Flag and Dr. Willi K.E. Weichelt, V'64, president of the Pennsylvania Veterinary Medical Association, administered the Veterinarian's Oath.



Presentation of the diploma by Dean Kelly.

Presentation of the Class Flag by VMAS President Dr. Suzanne Smith to Scott Weber, class president.



Class of 1997

Christopher Lawrence Allen*
David Henry Allgeier
Dexter Archer
Kimberly Dawn Ashford
Bonnie Sue Barr
Amy Irene Bentz
Laura Beres
Aimé Greene Berman
Danielle Mary Bistrichan
Jennifer Lynn Bouma
Barbara Dorothy Bower
Matthew Bruce Buck
Elizabeth Marion Bunting***
Michele Marie Campellone
Jodi Lynn Carlson
Jennifer Marie Carolan
Renée Marie Carpentier***
Kelly Ann Caruso
Jennifer Chaitman
Bryan Cherry**
Jaime Ann Collins**
Stacy Lyn Conarello
Nancy Jo Costa
Sarah Jova Cutler
Kathleen Napoli Davis
Regina Carole DeLorenzo
Robert Guerino DiGregorio
Jennifer Ann Dobson
Laurie Elizabeth Dohmen
Emily Louise Elliot

Carol Lynne Falck
Amy Anne Fauth
Amanda Elizabeth Fine
Dina Lauren Fox
Melanie Doreen Friedman
Stacy Heigo Fuchino
Michael Fugaro
Zeev Gans
Jennifer Helen Gilbert
Audrey Rebecca Greenstein
William Joseph Griffin
Henrietta Frances Haberstroh
Eveline Han***
Christine Noel Harshbarger***
Michelle Gibson Hawkins
Amy Alexandra Hinc**
Kaisa Helena Hodgkins
Russell H. C. Howe-Smith
Kelly A. Hullihen
Judy Tzi Shang Hung
Anita Impellizeri
Alisa Iriye
Pamela Joyce
Brian Andrew Karolewski
Christopher Keefe
Jennifer Lynn Kramer
Keith Eric Krebs***
Kirsten Jardine Kruer
Sarah L. Lavelly
Sherif Milad Lawendy

Daniel Lenhard
John Robert Lewis**
Christopher A. Lindquist**
John Douglas Maniatty
John Matthew Marcus
Scott Frederick Martens***
Anita Lynn McMillen
Mary Jane McNamee
Eugene Leonard Metzger
Lisa Ann Murphy
Margaret Anne Murphy
Rosanne Kay Myers
Ronald Allen Nash
Robert John Noto
Kelly Anne O'Connor
Kathleen Keiko Ogawa
Tammy Sue O'Roark
Walter Hyland Orth III
Rebecca Jo Ozimok
Robert Charles Panaccio, Jr.
Kelly Ann Papke
Lori Michele Perkins
Christine Elizabethann Phipps
Scott Allen Polo*
Mary Jane Potter*
Regina Lyn Quay
Malathy Rao***
Nirit Judith Rosenberg
Jonathan David Roth
Joanna Rubin

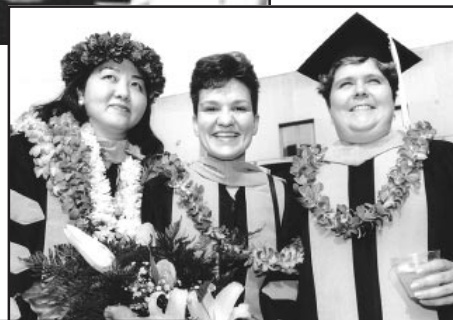
Michelle Lynne Rupp
Emi Kate Saito
Jennifer Marie Schneider
Patricia Akemi Schweibenz
Renee Frances Senz
Bonnie Hayes Shope
Katherine Ann Sinko
Mark Andrew Smith
Karen Eileen Spiegle†
Sarah Spikes
Starfinder Stanley
Arthur Bowers Stitzer IV
Andrea Denise Straka*
Maren Nina Troum
Robin Jill Turin
Erin duFief Vicari
Karen Lynn Watson
Ernest Philip Weber III
Meredith Lee Weltner
Helen Wheeler-Aceto*
Tracy Anne Winters*
Jenny Ann Witthoff
Melissa Anne Wyatt
Marie Yakubik
Michael Hua Yuan
Richard Allen Zappala II
Miriam Beth Ziering
***Summa Cum Laude
**Magna Cum Laude
*Cum Laude
†presented posthumously



Awarding of Honors by Dr. Charles Newton.



Hooding of the graduates by Dr. Urs Giger and Dr. Richard O. Davies.



Commencement speaker John A. Shaddock, D.V.M., Ph.D.



Awarding of the prizes by Dr. Patricia Sertich.



Award Recipients

Leonard Pearson Prize
Malathy Rao

J. B. Lippincott Prize
Scott Frederick Martens

1930 Class Prize in Surgery
John Robert Lewis

Auxiliary to the American Veterinary Medical Association Prize
Ernest Philip Weber III

Auxiliary to the Pennsylvania Veterinary Medical Association Prize—Small Animal Award
Scott Frederick Martens

Auxiliary to the Pennsylvania Veterinary Medical Association Prize—Large Animal Award
John Matthew Marcus

1956 Class Medal for Achievement in Pathology
Christine Noel Harshbarger

James Hazlitt Jones Prize in Biochemistry
Scott Frederick Martens

American Animal Hospital Association Award
Keith Eric Krebs

Merck Small Animal Award
Jaime Ann Collins

Merck Large Animal Award
David Henry Allgeier

George M. Palmer Prize
Arthur Bowers Stitzer, IV

Everingham Prize for Cardiology
Christopher Lawrence Allen

Large Animal Surgery Prize
David Henry Allgeier

Large Animal Medicine Prize
Bonnie Sue Barr

Morris L. Ziskind Prize in Food Animal Medicine
Amanda Elizabeth Fine

Morris L. Ziskind Prize in Public Health
Amy Alexandra Hinc

Hill's Award
Patricia Akemi Schweibenz

Pharmacia & Upjohn Small Animal Award
William Joseph Griffin

Pharmacia & Upjohn Large Animal Award
Helen Wheeler-Aceto

Faculty/SCAVMA Prize
Scott Allen Polo

American College of Veterinary Surgeons Small Animal Surgery Prize
Christopher A. Lindquist

American College of Veterinary Surgeons Large Animal Surgery Prize
Amanda Elizabeth Fine

American Association of Feline Practitioners Award
Renee Frances Senz

Phi Zeta Award
Bryan Cherry

Anatomy Prize
Helen Wheeler-Aceto

American College of Veterinary Radiology Award
Scott Frederick Martens

Iams/VECCS Award for Excellence in Veterinary Emergency and Critical Care Medicine
Russell H. C. Howe-Smith

Student Government Awards for Teaching Excellence

The annual presentation of the Student Government Awards for Teaching Excellence took place on April 11 at Longwood Gardens where a dinner dance was held. Students, faculty and staff gathered for an evening of fun, dining, dancing and presentations.

Each class voted on its selection of outstanding teachers. The graduating class selected three winners, the other classes selected one each. In recent years the awards ceremony has expanded to include also technician awards and this year Dean Kelly added the presentation of the Dean's Awards for Leadership in Clinical and Basic Science Education.

The event was supported by The Upjohn Company; the University of Pennsylvania School of Veterinary Medicine Veterinary Medical Student Government; Waltham, U.S.A.; SCAVMA, University of Pennsylvania; Mallinckrodt Veterinary; and General Econopak. 🏠

Harcum College Veterinary Technician Fall 1997 Seminars

October 11, Small Animal Behavior — Anne D. Beebe, D.V.M.

November 8, Urinalysis Refresher — Meryl Littman, V.M.D., D.A.C.I.M.

November 22, Pet Avian Management, Handling and Medicine — Liz Wilson, B.S., C.V.T.

December 6, Exotic Animal Hematology and Parasitology — Sandra Skeba, C.V.T.

The fees are \$40 for the morning lecture only, and \$75 for all day.

For more information or to register, please contact the Harcum College Continuing, Distance and Corporate Education Office by telephone at (610) 526-6100 or by fax at (610) 526-6086.



Dr. Cynthia Ward, assistant professor of medicine, is the recipient of the Class of 1997 Teaching Award.



Dr. Patricia Sertich, assistant professor of reproduction, recipient of the Class of 1998 Teaching Award.

Class of 1997 Teaching Award to Dr. Dan Brockman, assistant professor of surgery.



Dr. Steven Fluharty, professor of pharmacology in animal biology, recipient of the Class of 1999 Teaching Award.



Class of 1997 Teaching Award to Dr. Tony Mogg, lecturer in medicine, New Bolton Center.



Dr. Paul Orsini, assistant professor of anatomy, recipient of the Class of 2000 Teaching Award.

Class of 1997 Intern Teaching Award to Dr. Matthew Beal.



Class of 1997 Resident Teaching Award to Dr. Nicola Mason. She also received the Intern Mentor Award.

Stephanie Gibson, recipient of the Veterinary Technician Award.



Class of 1997 Technician Teaching Award to Joe Rogosky, VHUP.



Dr. David Holt, assistant professor of surgery, recipient of the Alumni Teaching Award.



Class of 1997 Technician Teaching Award to Kathleen Schoettle, VHUP.

Dr. Richard O. Davies, professor of pharmacology, recipient of the Dean's Award for Leadership in Basic Science Education.



Class of 1997 Technician Teaching Award to Jane Cohen, VHUP.



Class of 1997 Technician Teaching Award to Nancy Skinner, NBC.



Dr. Urs Giger, professor of medicine and medical genetics, recipient of the Dean's Award for Leadership in Clinical Science Education.

Scholarships



Lawrence Nann, recipient of the Veterinary Technician Award.

Richard Zappala, V'97, recipient of the Senior Student Patient Care Award.



Keith Krebs, V'97, recipient of the Senior Student Patient Care Award.

Dr. David Holt, recipient of the Residents' Teaching Award.



Dr. Jane Axon, recipient of the William B. Boucher Award for Outstanding Teaching at New Bolton Center by a House Officer.

Dr. Greg Griffin, recipient of the Silver Bedside Manner Award.



Dean Kelly and Julia Irwin, V'98, SCAVMA president, accept a check from Mr. James Jones, representing a gift of \$1,000 from Pharmacia and Upjohn.

The members of the Burlington County Kennel Club have awarded a scholarship to **Kerri Davis, V'98**.

The Dr. Ginnie Lieblein Memorial Scholarship has been awarded to **Claire Morissette, V'98**. **Melissa George, V'98** and **Shelly Wagner, V'98** are the recipients of a scholarship from the Bushy Run Kennel Club.

The Richard A. Dorr, Jr. Memorial Scholarship has been awarded to **Mark Doran, V'98**. The Iris M. McGee Scholarship has been awarded to **Elizabeth Krug, V'98**. **Ingrid denOuter, V'98** was awarded the Israel and Anna Live Scholarship. The Lois F. Fairchild Scholarship in Veterinary Public Service has been awarded to **Pandora Davis, V'99**.

The Dr. J. E. Salsbury Scholarship has been awarded to **Kerri Davis, V'98**,

William Bush, V'98, and **Morgan Cavanaugh, V'98**. The Anne Linn White Dean's Scholarships were awarded to **Linda Bender, V'00**, **Janna Makovoz, V'00**, and **Elizabeth Daniel, V'99**. The Mrs. Jack L. Billhardt Dean's Scholarship has been awarded to **Don Peterson, V'99**.

The Dr. M. Josephine Deubler Dean's Scholarship was awarded to **Emily Graves, V'99** and **Frank Von Esse, V'99**.


Heather Chalfant, V'00 and **Lara Slusarz, V'00** have both been awarded the Bruce J. Heim Dean's Scholarship. The Hill's Dean's Scholarship was awarded to **Avra Frucht, V'99** and **Kenneth Bixel, V'99**.

Recipients of the J. Maxwell Moran, Sr. Dean's Scholarship are **Felicia Berkowitz, V'98**, **Courtney Jones, V'98**, and **Heather Peikes, V'98**. The New York Farmers Dean's Scholarship has been awarded to **Jessica Stehr, V'98**. **George Motley, V'98** has been awarded the Edwin J. Andrews Dean's Scholarship.

Elizabeth Ewaskiewicz, V'98 has received the Palace H. Seitz Dean's Scholarship. The Class of 1967 Dean's Scholarship has been awarded to **Lisa Ziemer, V'98**. The Union County Kennel Club has awarded a scholarship to **Felicia Berkowitz, V'98**.

William W. Bush, V'98, **Heather Peikes, V'98**, and **Karen Phillips, V'98** have been awarded scholarships from the American Kennel Club. The Auxiliary to the Pennsylvania Veterinary Foundation has awarded scholarships to **Carolyn M. Lyon, V'98**, **William W. Bush, V'98**, and **Susan E. Monteforte, V'98**.

The Dr. Palace H. Seitz Memorial Fund has awarded a scholarship to **George A. Motley, V'98** and **Donna L. Riddle, V'98**. **Claire McNesby, V'98** has been awarded the Dr. Harry L. Schultz, Jr. Memorial Scholarship.

Linda Bender, V'00 has been awarded a scholarship from the Lancaster Kennel Club. The Starr Foundation has awarded a scholarship to **Mary Margaret Clements, V'00**. The Naugatuck Valley Kennel Club has awarded scholarships to **Brian Turgeon, V'00** and **Laney Jean Baris, V'00**. 

Jodie Drake, NBC, recipient of the VMSG Commendation Award.



Marie Yakubic, V'97, recipient of the Senior Student Patient Care Award.



27th Annual Canine Symposium

The 27th Annual Canine Symposium took place on January 25 at VHUP. The event, held in honor of Dr. M. Josephine Deubler, who organized the first Canine Symposium in 1970, focused on canine genetic diseases.



Genetic Disease

Dr. Donald F. Patterson, professor of medical genetics at the School, opened the seminar by displaying the cover of a recent issue of *Time* magazine that investigated dog breeding practices. He called the article — which asserted that purebred dogs are riddled with disease because of irresponsible breeding methods — an unjustified indictment of the dog breeding community. He said the problems can be more accurately assessed only by understanding the complex mechanisms of genetic diseases.

Genetic diseases are caused by mutations — or alterations in the structure and function of genes, rather than by the environment. Genes are comprised of DNA sequences. These sequences serve as templates for messenger RNA, which directs protein synthesis. Hence, genetic defects ultimately result in the manufacture of abnormal proteins — perhaps enzymes, biological receptors or structural proteins comprising cell membranes and connective tissues. Genes, which direct growth, development and function of the body's organs throughout life, number some 50,000 in every mammal. The genome of dogs differs from that of humans by only about 10-20 percent of the nucleotides. Thus, explained Dr. Patterson, "You can expect that all mammals will generally have the same number and kinds of genetic diseases."

Yet while some 5,000 genetic disorders have been mapped out in humans, a mere 350-or-so have been documented in the dog. Owing to a series of major scientific breakthroughs, this represents a logarithmic increase from the number of canine inherited diseases described in the 1930's, when just a handful of such

anomalies was recognized. "Because of the tremendous progress in the development of vaccines, antibiotics and nutritious diets," said Dr. Patterson, "we've gotten rid of a lot of the non-genetic problems and been able to concentrate our efforts on genetic diseases."

Our expanded understanding of genetic defects, which, in recent years, has led to the identification of about five to ten canine genetic diseases annually, can also be attributed to the development of modern diagnostic methods. A large percentage of genetic maladies documented in the dog thus far are orthopedic, ocular or neurological, perhaps because of the more obvious clinical signs they produce. But researchers are now striking major advancements in those genetic abnormalities that cause more subtle signs and challenge diagnostic methods.

One such case is vitamin B12 (cobalamin) deficiency, which was first described by a veterinary medical geneticist at the School. The first known affected dogs presented at a few months of age. They showed general signs of failure to thrive, including anorexia, anemia and weakness, and were small in relation to their litter mates. Using paper chromatography, researchers identified methylmalonic acid in the urine. The presence of this abnormal metabolite signals a defect in either an enzyme involved in the metabolism of organic acids or an enzyme cofactor. The problem in this case was found to be a lack of cofactor (vitamin B12) receptors in the ileum, where they are inserted following genetic translation. Unlike many genetic diseases, cobalamin defects have an effective therapy — parenteral administration of vitamin B12.

Vitamin B12 deficiency is an autosomal recessive disease, as are most understood genetic disorders of purebred dogs. In his retort to the *Time* magazine story, Dr. Patterson said that inbreeding — the mating of individuals that share common ancestry, does not cause genetic disease. Rather, he said, inbreeding can increase the chance of a disease-causing recessive mutant gene being transmitted in double dose to the offspring.

In order to eliminate recessive

diseases, Dr. Patterson explained, we must be able to recognize affected individuals and refrain from breeding them. But, he added, "That's not enough, because most of the genes that cause these recessive disorders are in the population in carriers. We don't know that an animal is a carrier unless it's bred to another carrier and produces affected individuals."

If, for example, the frequency of a defect were four percent and the affected individuals were removed from the breeding population, it would take over ten generations to reduce the frequency of disease to one percent. But if both the carriers and those affected were extracted from the breeding population, the disease would be eliminated in one generation. So the key to abolishing canine genetic diseases, Dr. Patterson said, is to identify carrier dogs.

To this end, the School has undertaken four major initiatives: research in biochemical and molecular abnormalities involved in specific genetic diseases; development of carrier tests based on detection of either abnormal gene products or structural changes in the DNA of mutant genes; operation of a genetics/pediatrics clinic at VHUP, where breeders and owners of animals with known or suspected genetic diseases can seek diagnostic services and genetic counseling; and development of a compendium of genetic diseases, to be published in book and software forms within the next year.



Screening for Inherited Diseases

Dr. Urs Giger, professor of medicine and medical genetics, discussed screening for inherited disease. In contrast to the common dominant inheritance of diseases in humans, most hereditary diseases in dogs are recessively inherited. In autosomal recessive inheritance both asymptomatic parents may contribute an abnormal (mutant) gene to an offspring which will then have two mutant genes (homozygous) and is, therefore, affected. Most metabolic and eye disorders are inherited

Molecular Genetic Tests

by an autosomal recessive trait. In x-linked recessive disorders, the asymptomatic dam will pass on one of her x-chromosomes to the male and female offspring, however, if the male inherits the x-chromosome containing a mutant gene, the males will be affected with e.g., hemophilia or muscular dystrophy. Finally, with complex traits such as hip dysplasia and certain cancers, environmental factors also play a role in the expression of the disease. Thus, in order to control hereditary diseases in dogs, it will be important not only to identify affected dogs, but also carriers which carry one copy of a mutant gene, but have no clinical signs.

Veterinarians and breeders have several tools to identify diseased animals. Since many genetic diseases are breed-specific, the signalment of an animal may suggest a disorder known to occur in that breed. Most diseases are associated with characteristic clinical signs which occur at a typical age. Neonates and juvenile dogs are more likely to suffer from a genetic disorder (this is known as the fading puppy syndrome), although a few genetic diseases may only cause signs in adulthood. Failure to thrive, growth retardation, and malformations are commonly seen, and neurologic and ophthalmologic signs may also be evident. In contrast to malnutrition, infections, and intoxications, the clinical manifestations are usually chronic progressive, however, genetic predisposition to infection and bleeding may be associated with intermittent signs. An easy way to recognize an unthrifty puppy early, is to regularly weigh puppies and compare with littermates. Routine blood and urine tests as well as imaging studies such as radiographs, ultrasound and ophthalmoscopy rule out many acquired diseases and may further suggest an inherited disorder.

The Veterinary School's Section of Medical Genetics has developed and established screening tests for many metabolic or hematologic hereditary disorders (see *Josephine Deubler Genetic Disease Testing Laboratory*). Since inborn errors lead to dysfunction of a biological pathway they can be identified by product deficiency and accumulation of substrates or alternative substances. A small urine

sample is often more helpful for these screening tests than serum or other specimens. For instance, specific sugars are found in urine of puppies with certain skeletal and neurological abnormalities known as mucopolysaccharidoses. Cystine, a poorly soluble building block of proteins, accumulates in dogs with cystinuria and can lead to kidney and bladder calculi, resulting in inability to urinate, an emergency situation.

We are aiming to not only identify the failing biological pathway in affected animals, but to determine the responsible protein that is defective. In fact, various gene defects may result in the failure of the same biologic function, thus, identification at the protein or DNA level is important to reach a specific diagnosis. The best examples are deficiencies of enzyme activities, inability of a receptor to bind, or a lack of transporters to move substances across a membrane. Such tests are now available for several dozens of genetic defects in dogs.

These specific functional and immunologic tests are not only useful to confirm a specific defect in an affected dog, but also to identify carriers. Carriers or heterozygotes, who carry one normal and one mutant gene, are asymptomatic, but can pass on the mutant gene to their offspring. Thus, in order to produce healthy dogs it is pivotal to recognize carriers and eliminate them from breeding. Although parents and offspring of affected dogs are obligate carriers, for others laboratory tests are needed to know whether they are carriers or normal. Instead of having the normal 100% specific enzyme function, carriers have intermediate activity or amount of approximately 40-60% compared to controls. Although very helpful, these carrier tests are time consuming and technically demanding, and require special specimen submission. Because of these difficulties, these carrier tests are not completely accurate. Therefore, it is exciting that for some of these inherited disorders, the molecular genetic defect has been identified which will simplify testing in the near future for many hereditary disorders in dogs.

Biochemical tests are useful in diagnosing specific inherited diseases. However, said Dr. Paula Henthorn, associate professor of medical genetics at the School, they have limitations. For example, they occasionally fail to distinguish carriers from normal dogs.

"Sometimes what we detect in the lab doesn't really represent what's going on in the animal," Dr. Henthorn explained.

The future generation of genetic tests will be based on DNA analysis. DNA, or deoxyribonucleic acid, is a double strand comprised of billions of the four nucleotide bases. "If you thought of each base pair as a bead on a string, that string would stretch from here to San Francisco," said Dr. Henthorn.

Of even greater consequence, a substitution, addition or deletion in just one of the six trillion base pairs in the genome can dramatically alter the protein a gene encodes. Such minute modifications can have deleterious consequences. For example, phosphofructokinase (PFK) deficiency, which leads to hemolytic anemia and exercise intolerance in the English springer spaniel, results from a single base substitution. X-linked severe combined immunodeficiency (XSCID), which is lethal in young dogs, is caused by a deletion of only four nucleotides.

Molecular genetic testing can be performed in puppies shortly after birth. In testing for a particular disorder, one must know what sequence mutation to look for. DNA can be isolated very non-invasively, perhaps in a drop of blood, hair follicle, frozen semen, or cheek cells. The polymerase chain reaction (PCR) is used to amplify selected DNA segments up to billions-fold so they can be examined. Restriction enzymes are then employed to cut the fragments of interest. These fragments are then run on gel electrophoresis, which separates them according to size and thereby distinguishes normal from abnormal fragments.

27th Annual Canine Symposium

Both PFK deficiency and XSCID, which are caused by mutations that create new restriction sites, can be diagnosed in this manner. But detecting the genetic aberration in a single dog is only half of the battle, Dr. Henthorn said.

“Once we’ve looked at an individual animal, we have to analyze the results in the larger context of what we know about the breed or the pedigree.”

Over 244 dogs were screened for PFK deficiency between 1993 and 1995. These mass diagnostic efforts shed light on the occurrence of the mutation throughout the springer spaniel breed. Likewise, the recognition of a single case of XSCID led to broad testing of the affected dog’s pedigree. Researchers at the School traced the defect back to the dog’s grandmother, flagged female carriers and advised owners on modifying their breeding strategies.

“These tests involve genetic counseling to understand the frequency of the marker you’re looking at and the inheritance in the pedigree,” Dr. Henthorn explained.

These sophisticated diagnostics are presently only available for heritable diseases caused by single-gene defects. But in this rapidly burgeoning field, Dr. Henthorn added, tests for multiple-gene disorders, such as hip dysplasia, will be developed in the years to come.



Hereditary Diseases Affecting Immune System

Primary immune deficiencies are genetic defects that compromise the immune response and thereby render affected individuals highly susceptible to infection. Dr. Peter J. Felsburg, professor of immunology at the School and chairman of the department of clinical studies at VHUP, explained the etiologies of several inherited immune disorders and discussed diagnostic methods.

White blood cells, or leukocytes, are the work horses of the immune system.

Their constituents, including B and T lymphocytes, monocytes and neutrophils, course through the peripheral circulation. Leukocytes develop from pluripotent stem cells and are renewed throughout life.

The major function of B lymphocytes is to produce antibodies (humoral immunity) that confer protection against bacterial infection. T lymphocytes, which direct cell-mediated immunity, fend off intracellular invaders, such as fungi, protozoa and viruses; a subset of T lymphocytes, helper T cells, regulate and enhance humoral immunity. Monocytes and neutrophils, the “garbage collectors” of the immune system, phagocytize foreign invaders. Complement - enzymatic proteins in the serum, combines with the antigen-antibody complex to stimulate lysis of potentially pathogenic antigen. A flaw in any of these immune components can cause an immunodeficiency syndrome, Dr. Felsburg explained.

“Where the genetic defect is in the development of the immune system determines how severe the immune deficiency is.”

Some 50 heritable immune deficiencies have been identified in humans. In the dog, only four or five have been documented. “These same 50 disorders should also be seen in the dog, and in higher incidence because of inbreeding,” said Dr. Felsburg.

The clinical features of immune incompetence in the dog include recurrent, chronic infections that are refractory to treatment; chronic diarrhea; growth retardation; and adverse reactions to modified live vaccines.

Several simple tests are used to diagnose canine immune deficiencies. They include quantification of antibodies or complement, measurement of B- and T-lymphocyte maturity through analysis of cell surface markers, and challenge assays to assess the competence of both the T lymphocytes (lymphocyte transformation test [LTT]) and the phagocytic system.

Among the significant primary immune deficiencies that have been reported in the dog are XSCID, selective IgA deficiency and leukocyte adhesion deficiency (LAD). In XSCID, both humoral and cell-mediated immunity are compromised. Af-

flicted dogs experience chronic infections that typically begin at a few months of age. These infections, usually bacterial, are generally unresponsive to antibiotic therapy. Affected dogs are smaller than their litter mates and exhibit marked failure to thrive.

Interleukin-2, or IL-2, stimulates T lymphocytes to proliferate in normal dogs. Dogs with XSCID lack IL-2 cell surface receptors. Likewise, they do not respond to IL-2 therapy. Two tests are used to diagnose XSCID. With the first, T cells are stimulated with antigen and IL-2 is added. T cell response is absent in affected dogs. The second test uses antibodies against IL-2 receptors to determine whether these receptors are present. Because XSCID is a recessive disease, carriers are not clinically affected. In hopes of purging the breeding population of this deadly gene, researchers at the School have developed carrier tests for XSCID.

Selective IgA deficiency, which leads to less severe recurrent infections, occurs quite commonly in dogs. It can be diagnosed with LTT or by measurement of the serum IgA concentration, which is profoundly depressed in affected dogs.

LAD is caused by defective integrins, proteins that enable phagocytes to bind to microorganisms. Signs of LAD, which occur at a few weeks of age, include recurrent pyogenic infections and poor wound healing. LAD is often diagnosed using flow cytometry to discern the presence of normal adhesion molecules.

Once an immunodeficiency has been identified using one of myriad screening tests, Dr. Felsburg said, more sophisticated assays can be employed to locate where the defect is. Researchers are working to pinpoint the genes responsible for these problems, and then develop carrier tests.



Heritable Renal Diseases

A variety of serious kidney disorders are encoded by genes. Likewise, they have breed predispositions, said Dr.

Meryl Littman, associate professor of Medicine at VHUP.

The kidney plays several homeostatic roles. It filters the blood through its glomeruli — small, convoluted tufts of capillaries, and excretes toxic waste products. The renal tubules resorb substances from the glomerular filtrate — such as amino acids, sugars, water and electrolytes, in amounts necessary to maintain hydration, acid-base balance, blood pressure and other normal parameters. Also, the kidney manufactures important vitamins and hormones.

As a homeostatic organ, the kidney is so efficient that it can serve all of the body's functions with just a portion of its nephrons, or functional renal units. The dog, for example, can lose one of its two kidneys and remain healthy. With a 67 percent loss of renal mass, it might exhibit polyuria/polydipsia (pu/pd), but serum measures of renal function, such as creatinine and blood urea nitrogen (BUN), are not affected. In fact, renal failure does not typically occur until about three-quarters of the renal parenchyma is destroyed.

Clinical signs of renal failure include pu/pd, dehydration, anorexia, vomiting, weight loss, anemia, hypertension and ascites. Laboratory tests typically show elevated BUN, creatinine and phosphorus.

Several inherited renal defects — renal dysplasia, glomerular diseases, tubular diseases and structural abnormalities — can lead to renal failure. Yet when they occur, these problems should not be assumed to be genetic; infectious and metabolic mechanisms, for example, may be the cause. In assessing their etiology, it is important to survey the affected dog's pedigree and consider whether a breed predisposition exists for the disorder.

Renal dysplasia is a congenital or neonatal disorder that results in maldevelopment of the kidneys. The renal reserve can be severely compromised by renal dysmaturity, predisposing the dog to progressive renal failure. Renal dysplasia is thought to be familial in the Lhasa apso, Shih Tzu, miniature schnauzer, Doberman pinscher, chow chow, soft coated wheaten terrier, golden retriever, and standard poodle breeds.

Clinical signs of renal dysplasia include poor growth, pu/pd, cachexia and “rubber jaw.” Blood work reveals elevated BUN and creatinine; urinalysis shows low urine specific gravity and possibly signs of urinary tract infection; and on radiographs, the kidneys appear small. A diagnosis can also be rendered by kidney biopsy, which may reveal maldeveloped fetal glomeruli and mesenchyme, and renal atrophy. Renal dysplasia is thought to be an autosomal recessive trait, but no carrier tests have yet been developed.

Unlike renal dysplasia, which usually presents in young dogs, glomerulopathies may emerge clinically at any age. They are characterized by protein-losing nephropathy, which leads to edema/ascites, hypertension and thromboembolism. Affected dogs have elevated BUN and serum creatinine, low serum albumin, and proteinuria. Glomerulonephritis and amyloidosis may be evident on biopsy. Like renal dysplasia, glomerulopathies seem to gravitate toward certain breeds of dogs, including beagles, Basenjis, Samoyeds, Labrador and golden retrievers, soft coated wheaten terriers, Bernese mountain dogs, Dobermans, bullmastiffs, bull terriers, English cocker spaniels, Rottweilers, and Sharpeis. Likewise, Dr. Littman cautioned, the pathogenesis of these disorders may vary from breed to breed.

“They may look the same on paper but there may be different genetic reasons for the problem,” she said.

Certain dog breeds are also predisposed to tubular diseases and structural anomalies. Telangiectasia occurs in some Pembroke Welsh corgi dogs. The Siberian husky appears prone to ectopic ureter and subsequent hydronephrosis.

“I think you can see how complex these renal disorders are and the variety of diseases that might present,” said Dr. Littman.

The genetic defects inherent in most inherited kidney disorders have not yet been identified, she added. But once these modes of inheritance are worked out, special breeding strategies may be devised to reduce the occurrence of these often-debilitating maladies.

Genetic Basis of Hip Dysplasia

Sound imaging techniques for diagnosing the presence of hip dysplasia are currently available. By incorporating the results of these tests into breeding programs, said Dr. Gail K. Smith, professor of surgery at the School and chief of the section of surgery at VHUP, we can select for better hips in future generations of dogs.

Hip dysplasia is the most common heritable orthopedic disease of the dog. Due to a misshapen femoral head (ball) or shallow acetabulum (socket), the ball-and-socket hip joint does not form a tight union in dysplastic dogs. Consequently, these individuals have lax, or loose-fitting, hips. Joint laxity may, depending upon the severity, over time lead to degenerative joint disease (DJD), or arthritis.

Hip dysplasia in the dog was first described in the 1930s. After decades of research on the disorder, why are there still so many dogs walking around on bad hips? For one thing, little is known about the genetic scheme and molecular patterns of hip dysplasia. What is understood, however, is that hip dysplasia arises from a complex form of inheritance. Its expression is polygenic and multifactorial; in other words, many genes, as well as environmental factors, influence its development.

The other reason hip dysplasia is ubiquitous is that dysplastic dogs have not been kept out of the breeding pool because, until recently, their disorder was not accurately diagnosed. In 1983, Dr. Smith developed the PennHIP® program, which utilizes a highly reliable method for diagnosing hip dysplasia. By the PennHIP® method, radiographs are taken when the dog's hips are in the neutral (standing) position, which allows maximum laxity. (The traditional position used for evaluating hip status was legs fully extended.) The femoral heads are then manually pushed laterally out of the acetabula as far as they will easily go. A

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distraction index (DI), which measures the distance the heads can be pushed out of the joint, is then calculated. The DI is numbered 0 (no laxity) through 1 (complete laxity). A DI of .75, for example, indicates that the hips can be translated 75 percent from the congruent position.

But, said Dr. Smith, “The fact that we can measure laxity is meaningless unless we can link it to future development of osteoarthritis.”

Ongoing research indicates that hip laxity is the most important factor in predicting DJD. Tighter hips are better hips, Dr. Smith said. But, he added, arthritis susceptibility is also highly breed dependent. In other words, different breeds of dogs have different degrees of tolerance of laxity in their hip joints; for example, German shepherd dogs are more likely to develop arthritis, given the same amount of laxity, than are Rottweilers. Environmental factors can also dramatically influence the expression of arthritis in an arthritis-prone dog.

Studies show that an individual’s DI is consistent over time. Dogs have essentially the same amount of laxity as puppies as they do years later. Thus, hip laxity can be accurately determined as early as four months of age, well before a dog is ready to be bred. This is important because hip dysplasia is a highly heritable disorder.

Heritability is a measure of the total variability in phenotypic traits attributable to genetic differences among individuals. Hip dysplasia has a high degree of heritability, according to the results of an extensive, soon-to-be-published study Dr. Smith conducted that showed dysplastic dogs parent dysplastic puppies. Breeders can place heritability in their corner by applying selection pressure to their breeding populations, Dr. Smith explained. The more selection pressure they apply, the greater the change in the trait from one generation to the next. Key to this strategy is accurate identification of healthy individuals.

“We must rely on diagnostic tests to help us cleanse this gene pool of the bad genes,” Dr. Smith said.

Breeding the extremes for a particular trait will attenuate of the expression of

that trait rather rapidly. In a study conducted in the mid ‘80s, test matings of an isolated population were performed. After evaluating the hips of 71 German Shepherd dogs, a male and a female were identified with DIs similar to those of racing greyhounds, 0.21 and 0.19 respectively. These two dogs were mated and the resultant litter had a mean DI of .27, which represented a 60 percent shift from the original breeding population. Successive breedings were monitored for several years thereafter. By 1991, two generations later, 80 percent of the kennel’s output had DIs below .3.

Such success can be replicated in other populations of dogs. By utilizing PennHIP’s services to obtain accurate ratings of hip laxity, breeders might then design breeding protocols that select from the tight half of the breed in each generation interval. Thus, they can effect a moderate rate of genetic change with each consecutive generation without losing desirable traits or increasing the likelihood of introducing new undesirable characteristics.



Hereditary Eye Diseases

Canine inherited retinal degeneration causes characteristic optic changes that are consistent among various breeds. But what appears to be a single disorder, said Dr. Gregory M. Acland, adjunct associate professor of ophthalmology in medical genetics at the School, is not.

“There are lots of clues that the disease may be different intrinsically from breed to breed,” he said.

Progressive retinal atrophy (PRA) is a gradual, blinding disorder. Affected dogs develop degenerative changes in the retina with age. Early in the disease, they become night blind. As more of their photoreceptors degrade over time, these dogs lose their day vision as well. The pupils of their eyes become increasingly dilated and prone to developing cataracts.

Upon indirect ophthalmoscopic examination, several pathologic changes are evident: hyperreflectivity of the tapetal

fundus; reduced diameter and branching pattern of retinal blood vessels; and atrophy of the optic nerve head. Diagnosis can be confirmed by either electroretinography or retinal morphological examination.

The major indicator that PRA represents several different pathogenetic mechanisms is the breed-related difference in the age of onset and rate of progression of the disease. Certain breeds, such as the collie, Irish setter, Norwegian elkhound and miniature schnauzer, have early-onset forms of retinal degeneration. In these breeds, the disease results from abnormal or arrested development of the photoreceptors and affects dogs early in life. In other breeds, such as the miniature poodle, Labrador retriever and cocker spaniel, PRA has much later onset.

Studies were conducted to determine whether all of the early-onset forms — though they occur in several dog breeds, represent the same molecular disease pattern. In one trial, the test mating of an affected Irish setter to an affected elkhound produced a litter of unaffected puppies. The phenotypically-normal puppies (carriers of both disorders) were then bred to affected collies. This second litter consisted of all normal puppies. Given that PRA is an autosomal recessive trait in all breeds but the Siberian husky — in which it is x-linked recessive, it is apparent that different genetic forms of PRA occur in the three breeds.

Likewise, test matings were conducted between dogs of several breeds that develop late-onset PRA. The results of these matings pointed toward a single gene at work. Thus, the late-onset forms of PRA result from mutations in the same gene.

Mutations in a variety of phototransduction genes have been implicated in retinitis pigmentosa, the equivalent disease in people to PRA in dogs, and in retinal degenerations in mice. These include for example, mutations in the genes for rhodopsin — the photosensitive pigment in rods, and for the phototransduction enzyme phosphodiesterase (PDE). Defects in the PDE-beta gene, for example, have been found to cause PRA in dogs and humans; PDE-alpha mutations cause retinitis pigmentosa

in humans; and PDE-gamma gene knock-outs produce retinal degeneration in mice.

But confounding these data is the fact that anomalies in a single gene such as RDS/peripheral can continue to lead to a variety of disorders with different patterns of inheritance. In fact, individuals from the same pedigree with the same mutation may exhibit different disorders phenotypically.

“The pathogenesis of these diseases is not quite as clear as we had hoped,” said Dr. Acland. Considerable effort has been expended in evaluating these genes as candidates for the mutant locus in several forms of PRA, and a PDE-beta mutation has been identified as the cause of PRA in Irish setters. Despite this success, however, the end result of all other studies to date has been to prove that PRA is not caused by mutations in these phototransduction genes.

In order to delineate these disease mechanisms, researchers are working to pinpoint the genes responsible for PRA in specific breeds. A reliable DNA test for the presence or absence of rod-cone dysplasia 1 (*rcd1*), which causes early-onset PRA in Irish setters, already exists. But the molecular bases of the other early-onset forms, as well as late-onset progressive rod-cone degeneration (*prcd*), are still being mapped out.

Research on the molecular foundation of retinal degeneration is now turning toward mapping the genes and loci responsible for disease, as well as developing marker tests to spot defective alleles and trace their patterns of inheritance. These investigations have broad implications, Dr. Acland said.

“Progressive retinal atrophy is really a paradigm for all the hereditary eye diseases.”

...and perhaps for other genetic diseases as well.



Treatment of Genetic Diseases

Even the best detection systems to diagnose and prevent genetic diseases don't alleviate the need for therapy to treat disorders produced by new mutations, said

Dr. Mark E. Haskins, professor of pathology and medical genetics at the School.

“It's possible to treat these diseases by getting around the genetic problems that exist,” he said.

Several therapeutic approaches exist. The simplest of these is direct, phenotypic treatment. These include reconstructive surgery for structural malformations, such as polydactylism, hip dysplasia, and patent ductus arteriosus.

“But this type of treatment is dissatisfying in some respects,” Dr. Haskins said.

The reason, he explained, is that it doesn't really get to the core of the problem. Using NIH funding, Dr. Haskins is testing a variety of treatment modalities for genetic defects.

For metabolic problems, there are therapies that work at the biochemical level. They might limit the availability of a compound in the diet that can become toxic due to genetic deficiencies in processing, remove the toxic product made by the body, or provide a missing non-protein product, such as vitamin B₁₂.

For disease caused by dysfunctional or deficient proteins, it's possible to either enhance the activity of the defective enzyme or provide the normal gene product, such as insulin or enzymes. For example, a dog with exocrine pancreatic insufficiency has inadequate secretion of digestive enzymes. These enzymes can be therapeutically replaced in the food, thereby eradicating the clinical manifestations of maldigestion and malabsorption. For a dog with von Willebrand's disease, which is characterized by the deficiency of clotting factors that leads to prolonged bleeding, the missing coagulation proteins can be restored by plasma infusion.

Enzyme replacement can also be used for lysosomal storage disorders. These diseases encompass a variety of rare, genetic (mostly autosomal recessive) defects described in several breeds, including the beagle, German shorthaired pointer and wirehaired dachshund. Lysosomes - small intracellular organelles that contain hydrolytic enzymes — are the “little garbage disposals of cells,” Dr. Haskins said. Deficiency of any of these enzymes can lead to accumulation of metabolites inside the lysosome. Dr. Haskins

likened the lysosomes that become grossly enlarged in these storage disorders to ping pong balls that grow to the size of basketballs.


“We're trying to understand why taking a cell and filling it with basketballs as opposed to ping pong balls makes these animals look the way they do, and then treat them,” Dr. Haskins explained.

Animals with one group of these disorders, mucopolysaccharidosis, exhibit stunted growth, facial dysmorphism, corneal clouding, organomegaly, and neurological and skeletal abnormalities. Human children with mucopolysaccharidosis are mentally retarded and typically die by the age of ten.

Lysosomal storage diseases are caused by defects in the genes coding for lysosomal enzymes. Replacement enzymes can be produced in vitro by genetically-engineered cells and then infused into affected individuals. This has been shown to be successful in children, but may not work well in the dog because of an immune response to the new enzymes and also must be given IV weekly for the life of the dog.

Heterologous transfer through bone marrow transplants, given intravenously from normal to affected siblings, has been effective in the dog. In this method — known as “cross correction” — Dr. Haskins said, “We give normal cells as enzyme factories. They make the enzymes, which are then delivered to the rest of the body. The hope is that these enzymes travel to the bone, cornea, heart valves and all the other affected organs.”

Gene transfer can also be a permanent fix to the problems caused by mutant genes. It involves cloning normal copies of a defective gene and then delivering them, via retrovirus vectors, to the patient's own abnormal cells. Still in the experimental stages, this method, which also utilizes bone marrow transplantation, has several hurdles to overcome before it can be used clinically.

These innovative therapies incorporate different approaches ultimately designed to alleviate disease in affected dogs. Yet with years of experimentation ahead, they are still at the bottom of the refinement curve. 

—Joan Capuzzi, V'98

Rosettes & Ribbons

The **School's Web Site** had about 250,000 "hits" in June. You can reach the site through <<http://www.vet.upenn.edu>>. We are in process of building various pages. *Bellwether* will be on-line as will be an events calendar.

Dr. M. Josephine Deubler, V'38, was awarded the Mark L. Morris, Sr. Lifetime Achievement Award for Contribution to the Health and Well-Being of Dogs. The award is presented by Hill's Pet Nutrition, Inc., and the company made a donation of \$20,000 to the Morris Animal Foundation in Dr. Deubler's honor. The Westminster Kennel Club announced that Dr. Deubler will be the Best in Show judge at the Westminster Kennel Club dog show on February 17 and 18, 1997 at Madison Square Garden, New York.

Dr. Sydney Evans, V'77, assistant professor of radiology, has received an NIH grant to study the presence of hypoxia in human cancers. She was a speaker at the international meeting of the Society of Oxygen Transport to Tissue in August in Milwaukee, WI.

Dr. Gregory Bossart, V'78, has been much in the print and electronic news as he and other researchers try to determine the causes of death of manatees in Florida waters.

Dr. Eileen B. Rowan, V'77, has been selected as 1997 Woman of Distinction by the Soroptimist International of Nassau County for her volunteer work for the Lakota Sioux Indians from the Rosebud Reservation. Dr. Rowan, a practitioner in Bayville, NY, was formally adopted into a Lakota Sioux family in 1996. For a number of years she and her clients have actively supported the Indians on the reservation through visits and donation of medical equipment and other items.

Dr. Leonard C. Marcus, V'62, received the Distinguished Service Award from the Massachusetts Veterinary Medical Association for his contribution to organizational aspects of veterinary medicine in Massachusetts and his consultative

assistance in the area of diseases transmitted from animals to man.

Dr. Robert Poppenga has been promoted to associate professor of toxicology. **Dr. John Wolfe, V'82**, has been promoted to professor of pathology in pathobiology. **Dr. Steven J. Fluharty** has been promoted to professor of pharmacology and toxicology.

Dr. Derek Hughes, senior lecturer in emergency and critical care medicine, has been appointed the head of the Credentials Committee and a member of the Board of Regents of the American College of Veterinary Emergency and Critical Care Medicine.

Dr. Max Van Buskirk, V'56, recently retired director of the Bureau of Animal Industry, Pennsylvania Department of Agriculture, was honored by the Pennsylvania Department of Agriculture, the Maryland Department of Agriculture, and the Mid Atlantic Poultry Health Council at that organization's annual meeting for his many contributions to animal agriculture and to the poultry industry in particular.

Dr. Charles D. Knecht, V'56, professor of small animal medicine and surgery and head of the Small Animal Clinic at Auburn University's College of Veterinary Medicine, retired on June 1.

Dr. Howard Krum, V'92, chief veterinarian at the New England Aquarium, developed a permanent exhibit entitled *Aquarium Medical Center*. This is a working animal care laboratory which offers visitors a behind-the-scenes-look at the Aquarium's veterinarians treating everything from fishes, turtles, seals to penquins. The exhibit is a big hit.

Dr. Karen Overall, V'83, director of the behavior clinic at VHUP, is the author of *Clinical Behavioral Medicine for Small Animals*, published by Mosby. Dr. Overall recently received her Ph.D. from the University of Wisconsin. She was an invited speaker at the 1997 WASVA meeting in Birmingham, UK, where she presented lectures and three papers.

Dr. E. Neil Moore, professor of physiology in medicine, presented an invited lecture and chaired a symposium on "Electrophysiological Mechanisms of Arrhythmias in Ischemia, Reperfusion and Myocardial Infarction" at the North American Society of Pacing and Electrophysiology, held in May in New Orleans, LA.

Dr. Nicola Mason was promoted to lecturer of medicine. At the 1997 American College of Veterinary Internal Medicine Dr. Mason received an ACVIM Resident Research Award for her paper "Evaluation of Combined Cyclophosphamide and Prednisone Versus Prednisone Alone in the Treatment of Canine Immune Mediated Hemolytic Anemia." At the same meeting, **Dr. Rebecka Hess**, recently appointed staff veterinarian of medicine at VHUP, received the Comparative Gastroenterology Society Research Abstract Award for her paper "Effect of Metoclopramide and Domperidone on Feline Gastric Smooth Muscle."

Dr. Joan Hendricks, V'79, has been promoted to professor of critical care and chief, Section of Critical Care at VHUP. **Dr. Kenneth Drobatz** has been promoted to associate professor of emergency and critical care. **Dr. Lesley King** has been promoted to associate professor of critical care.

Dr. Beth Callan, V'88, has been appointed assistant professor of medicine. **Dr. Amy Kapatkin** has been appointed assistant professor of orthopedic and neurosurgery and **Dr. Dorothy Brown** has been appointed assistant professor of soft tissue surgery.

Dr. Deborah Mandell, V'93, and **Dr. Katharine Palmer** were promoted to lecturers of critical care. **Dr. Anke Langenbach** was appointed lecturer of surgery and **Dr. Margaret Sleeper, V'93**, was appointed lecturer of cardiology.

Dr. Karin Sorenmo has been appointed assistant professor of oncology. **Dr. Heather Swann, V'93**, was appointed staff veterinarian of surgery at VHUP. **Dr. Lillian Duda, V'90**, was appointed lecturer in radiation oncology.

Special Gifts

The following contributed gifts to the Friends of New Bolton Center in memory of the person listed:

Ms. Catherine C. Larmore in memory of Patricia B. Stuart
M. Lynn Myers, V.M.D. in memory of Mr. Richard Murphy
Mr. and Mrs. Arthur Ritter in memory of Dr. William B. Boucher
Ms. Carol A. Wolf in memory of John Jacob "Jake" Wolf and "RUSTY"
Ms. Faith Wright in memory of Mr. Bobby Bright

In memory of Mr. James Harris:

The Buckeye Dairy Club
The Ciatteo Family
The Cocco Family
Mr. and Mrs. Robert M. Davis
The Francisco Family
Mr. and Mrs. Robert C. Hughes
Mr. and Mrs. L. Stockton Illoway
The Kramer Family
Mr. and Mrs. Henry H. Krimmel, Jr.
Mr. and Mrs. Gerard J. McCafferty
Mr. Norman T. McClelland
Mr. and Mrs. Donald McKinney
Mr. and Mrs. Devereaux N. Saller
Norton Scott Residents Assembly at Ohio State University
Mr. and Mrs. Robert S. Webb
Ms. Roberta R. Winemiller

The following are gifts made to the Marshak Dairy in memory of James Harris

Mr. and Mrs. Clarence R. Bryan, Jr.
The Delaware County 4-H Teen Council

Gifts made to the Friends of New Bolton Center in honor or thanks to the following:

Fox Chase Farm in honor of Dr. Mary-Beth Hamorski
Ms. Janet Jackson-Gould in honor of the Draft Horse Enthusiasts
Two gifts were made by Neal C. Ralston, V.M.D. in honor of Drs. Corinne Sweeney and Ray Sweeney
Mr. and Mrs. David R. Halliday in honor of "CENIZA"

The following are gifts made to the Friends of New Bolton Center in memory of a beloved animal:

Mr. and Mrs. Ronald Ani in memory of "BRAMWELL"
Ms. Barbara Bauer in memory of "WOODSTOCK"
Ms. Ruth Ann Fitzpatrick in memory of "SOCRATES"
Mr. Ronald M. Havener in memory of "RUBLE"
Dr. Jennifer L. Lewis in memory of "BLAZE"
Lockwillow Avenue Animal Clinic in memory of "MIKE," "PRINCE," and "FOLLY"

Ms. Susan W. Sensor in memory of "CARUSO" & "PERRY"
Mr. and Mrs. J. K. Simmers in memory of "GINGER"
Unionville Equine in memory of "COSMOS"
Ms. Theresa A. Zappone in memory of "SUNSHINE"

The Following are gifts made to New Bolton Center in memory or honor of those listed:

Ms. Allyne Greco in honor of Dr. Eric Parente and Dr. Virginia Reef
Edward Mersky, V.M.D. in memory of "PEE WEE"
Frank K. Reilly in memory of "JILL'S FLAGGER"
Richboro Animal Hospital in memory of "EFFIE"
Mrs. Doris Ritter in memory of Dr. William B. Boucher

The following have made donations to the Transfusion Medicine Fund in memory of Starr Richardson Hayes:

The Family of Starr Hayes
Mr. and Mrs. Harry and Karen Bower — to support the Bloodmobile (Transfusion Medicine Fund)
Mr. and Mrs. Saul Freedman — to support the Gail K. Smith Research Fund (Hip Dysplasia)
Dr. Frederick Munz and Family
Old York Road Dog Training Club
Friends at D.F. Blumberg & Associates
Ms. Cindy Maser

The following have contributed gifts to the Friends of the Small Animal Hospital in memory of a special pet:

Mr. and Mrs. Ted and Pat Baer in memory of "SPARKY"
Mr. and Mrs. Edward Goldston in memory of "GISMO"
Mr. and Mrs. Larry and Gilda Hunt in memory of "MISSY," "JAY JAY," and "SHANE"
Mr. and Mrs. Richard Walters in memory of "JESSIE"
Mr. and Mrs. Nelson B. Watton, Jr. in memory of "REX"
Mr. David Scott in memory of "CRICKET"
Mr. and Mrs. Chris Berger in memory of "TED"
Mr. William Gauthier in memory of "LADY"
Mr. and Mrs. Marvin Weber in memory of "DEWAR"
Ms. Margaret McMonagle in memory of "DONEGAL"
Mr. Flora Altus in memory of "AURORA"
Daniel L. Baker, V.M.D. in memory of "ROSIE"
Dr. and Mrs. Robert A. Moody in memory of "A KODIAK BEAR CD CDX"
Mr. Gary Goldberg in memory of "ALGERNON"
Ms. Linda Johnson & Ms. Shelagh Byrne in memory of "DIZZY"
Mr. and Mrs. Nalle in memory of "SPARKY"

Ms. Susan Barrett, Mrs. Helma Weeks, and Mrs. Pat Hall in memory of "BANDIT" and "DUSTY"
Mr. and Mrs. Charles Carter in memory of "JELLY BEAN"
Ms. Shari and Mr. Steven Pirone in memory of "SMOKEY TERRAIN"
Mr. and Mrs. Pat Sweeney in memory of "CHIPS"
Mr. and Mrs. Wayne Bonde in memory of "JODI"

The following have contributed to the Friends of the Small Animal Hospital in honor of those listed:

Mr. and Mrs. Paul Mellon in honor of Dr. Alix Wetherill

The following have made donations to the Humanitarian Fund in memory of Yale Mann:

Ms. Marilyn (Sugar) Blum
Ms. Sharon Chipin
Ms. Hermoyne M. Sundheim
Mr. and Mrs. Ralph T. Buchsbaum
Ms. Roslyn Bralow
Mr. Richard M. Laub
Mr. and Mrs. Leonard Buten
Mr. and Mrs. Reynold Greenberg, Jr.

In memory of Wilda Ash:

Ms. Maralyn Feige

The following have contributed to the Humanitarian Fund in memory of L. Stewart Cochrane:

Ms. Nancy Lawrence
Ms. Joy Graeme Messinger
Kennel Club of Philadelphia
Mrs. Helma Weeks
Dr. Josephine Deubler

The following have contributed to the Canine Epilepsy Fund in memory of William Newing:

Mr. and Mrs. Russell A. Broxholm
Mr. and Mrs. Robert Dute
Ms. Nancy L. Fahy
Mr. and Mrs. Walter Schlotterbeck

The following have contributed to Alumni Annual Giving in memory of William Newing:

Ms. Elizabeth Baily
Mr. and Mrs. Warren A. Crapo
Mr. Olle E. Haggstrom
Ms. Dana and Ms. Ruth How
Ms. Corinne B. Howard
Mr. Boardman F. Lockwood
Ms. Jill A. Manfredi
Ms. Kay McNabb
Turnpike Animal Hospital, PC
Fairfield Equine Associates, PC
Mr. David Piske
Ms. Anne M. Piske
Mr. Morris W. Wilson

In memory of Michael W. Deford:

Mr. and Mrs. J. Deford, Jr.



Animal Crackers

Popular Breeds

The Cat Fanciers Association reports the most frequently registered cats. This is the world's largest registry and the tally suggests worldwide preferences for pedigreed cats.

1. Persians
2. Maine Coon
3. Siamese
4. Abyssinian
5. Exotic
6. Oriental
7. Scottish Fold
8. American Shorthair
9. Birman
10. Ocicat

The Exotic is a Persian hybrid with a short, easier to care for coat. Its nickname is the "lazy person's Persian." The Oriental resembles the Siamese but does not have the points. It comes in many solid colors, tabby patterns, part-colors and bi-colors. The American shorthair was called the Domestic shorthair until 1966. It is North America's own breed and its ancestors came here with the early European explorers. The Birman is the "Sacred Cat of Burma." It has distinctive white markings ("gloves") on all four feet.

The American Kennel Club registered 1,332,557 dogs in 1996. The top ten breeds were:

1. Labrador retriever
2. Rottweiler
3. German shepherd dog
4. Golden retriever
5. Beagle
6. Poodle
7. Dachshund
8. Cocker spaniel
9. Yorkshire terrier
10. Pomeranian

The Labrador retriever has been

America's most popular breed for the past six years. From 1929 to 1935, Boston terriers, now ranked 21st, were the most popular breed. Cocker spaniels were first from 1936 to 1952 and from 1983 to 1990. Poodles were at the top of the list for 22 years (1960 to 1982). The list has 143 breeds registered, including three in the Miscellaneous Class (Anatolian shepherd dog, Havanese and Löwchen).

President's Dogs

Socks Clinton probably is the first cat known as an important member of the President's household, but dogs seem to be in the majority as residents of the White House. Fala, a Scottie, was an inseparable companion of FDR. It is said that a destroyer was sent to fetch him when left behind on a trip. Fala stood at attention when the national anthem was played. Richard Nixon's speech about his cocker spaniel, Checkers, probably rescued his political career. Lyndon Johnson is remembered for his beagles, Him and Her, especially when he was photographed lifting them by the ears.

Warren Harding had an Airedale, Laddie Boy, who had his own chair to sit in during cabinet meetings and he had a birthday party with the neighborhood dogs invited for an iced dog biscuit cake. Teddy Roosevelt had a favorite terrier, Skip, found while hunting in the Grand Canyon. Herbert Hoover had a German shepherd, King Tut.

The Lincoln's Fido was the first presidential dog to be photographed. He was part of his master's funeral procession and his photograph by Ingmire became a national best-selling card-photo.

George Bush's springer spaniel, Millie, dictated a book on the best-seller

list to First Lady Barbara Bush. The Kennedy's had a number of dogs. Charlie, a Welsh terrier, was the first dog they brought to the White House, but many more came to them as gifts. Pushinka, a daughter of the Russian space dog, Strelka, was a present from Premier Krushchev and passed security inspection as a possible spy dog.

It was Harry Truman who said, "If you want a friend in Washington, get a dog." There are hundreds of stories and several books documenting this interaction between man and animal.

Laboratory Tests

Laboratory tests are used in making accurate diagnoses or as part of a routine physical examination.

Complete Blood Count (CBC) — includes red cells, white cells, hemoglobin, and platelets. The differential count identifies the different types of white cells. The white cells can indicate bacterial or viral infection as well as diseases such as canine malignant lymphoma. The red cell count and hemoglobin indicate anemia when lowered. Anemia may be due to chronic blood loss or iron deficiency. Platelets are decreased in bleeding disorders.

Blood Chemistry findings aid in the diagnosis of kidney, liver, pancreas and other organs.

Blood Glucose, when elevated, is commonly associated with diabetes mellitus and other endocrine diseases. Low blood sugar may indicate an insulin-producing tumor of the pancreas.

Blood Urea Nitrogen and creatinine, when elevated, might indicate kidney disease. There are many other tests which may be used.

Heartworm is confirmed by the presence of immature *Dirofilaria*

immitis or circulating antigen or parts of the parasite in the blood.

Fecal Flotation is used to detect intestinal parasite ova and protozoa, so that proper medication may be prescribed.

Skin Scrapings are examined microscopically to identify parasites like sarcoptic and demodectic mange mites.

Urinalysis is used for screening diseases of the kidney and urinary tract. When the sediment is examined microscopically, the information can lead to a diagnosis of infection or malignancy.

Culture and Sensitivity is used to select an effective antibiotic to treat a bacterial infection.

This is a very brief overview of the many tests available and their indications. When indicated, they can be an important aid in diagnosis.

Hot Weather Notes

Heatstroke is life threatening for dogs and cats, although cats rarely get overheated. In dogs, the signs are heavy breathing, staggering gait, bright red gums and tongue. If heatstroke is suspected, get the animal into a cool place, wet it down with cold water and get it to a veterinarian for emergency treatment as soon as possible.

Never leave a dog in a closed car — the sun can make it a death trap in just a few minutes. Keep clean, fresh water available at all times and feed in the cooler hours of the day. Provide a cool, shady sleeping place.

Vaccinations should be up-to-date, particularly to prevent Parvo virus, an illness that flourishes in hot weather. Rabies vaccinations should be current as time spent outdoors increases the chance of encounters with wildlife (possible rabies carriers).

Heartworm Medication may be recommended by your veterinarian. Heartworm is transmitted by mosquitoes and can be prevented with monthly medication between June and November.

“Hot Spots” usually appear when dogs have scratched because of reaction to fleas. Daily brushing or combing is a way to check for fleas and ticks. See the

veterinarian for preventives and treatment of the big, wet skin lesions.

“High Rise” Syndrome cats increase dramatically in the summer. Cats sustain fewer injuries when falling from greater heights but the most severe injuries occur when they fall from second or third story windows. Keep windows heavily screened or closed.

Garbage should be kept where dogs won't get it. Eating it can cause serious illness. Corncobs and bones are common foreign bodies found in the stomach and intestines. They can be life-threatening and expensive to remove.

Remember that leashes can be life savers. They can prevent dashing into traffic, chasing after other dogs or squirrels and other escapes that might result in injuries.

Your Aging Cat

By Kim Campbell Thornton and John Hamil, D.V.M.

(Macmillan USA/Howell Book House, 1633 Broadway, New York, NY 10019 \$24.95 hardcover).

Sub-titled “How to Keep Your Cat Physically and Mentally Healthy Into Old Age,” this book is an excellent guide to caring for cats over eight years of age. Cats number over sixty million and are the fastest growing group of pets in the United States. Their low-maintenance requirements are important in today's society — and a relationship with a cat has important emotional and physical benefits.

The average cat life span is 10 to 14 years, but protected cats frequently live into their 20's. One cat is reported to have lived to age 36. A one-year-old cat is comparable to a 15 year-old human and a nine-year-old cat is approximately the same physical age as a 52 year-old human. Altered cats that live indoors are most likely to live longer.

In general a cat's geriatric years begin when it is 8 to 10 years old. Regular physical examinations are helpful. The authors discuss signs that indicate veterinary attention is needed. These include gain or loss of more than a pound,

vomiting, drinking more water than usual, change in appetite, gum and teeth problems, dry or dull coat and a change in energy level. With regular home examinations, including grooming, many illnesses can be detected before they become serious.

Massage techniques are discussed along with other alternative therapies such as acupuncture and homeopathy. There is a chapter on home care — giving medication and first aid. Some human medications are toxic to cats (ibuprofen, acetaminaphen and phenylbutozone). There is an appendix listing board-certified feline practitioners, books, magazine and even cat retirement homes. A glossary gives definitions of technical terms. This book covers just about all you need to know about your cat's aging process.

Vaginal Hyperplasia

Vaginal hyperplasia is a condition usually seen in young large-breed bitches, including Saint Bernards, bulldogs, boxers as well as other brachycephalic (short-nosed) breeds. It is thought to be caused by dysfunction. There is edematous enlargement of the vaginal floor and this may develop into an alarming mass of protruding vaginal tissue which may preclude natural breeding. The condition must be differentiated from vaginal prolapse which results in a “doughnut-shaped” mass protruding from the vulva.

The problem usually occurs during estrus. It may interfere with natural breeding. Rarely, it may occur at parturition and interfere with normal whelping.

Treatment usually consists of keeping the exposed tissue clean and lubricated with antibiotic ointment. In most cases, it will regress during diestrus. If the bitch is not to be bred, hormonal treatment in early proestrus may prevent development of hyperplasia. The treatment prevents ovulation, so it cannot be used in bitches intended to be bred.

The only permanent cure is ovariectomy. In some cases, surgical resection may be indicated.

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January 28 and 29, 1998

Penn Annual Conference

Adams Mark Hotel, Philadelphia

January 31, 1998

28th Annual Canine Syposium

Entire program on oncology for dogs
VHUP, Philadelphia

April 4, 1998

21st Annual Feline Symposium

VHUP, Philadelphia

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