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Seventeenth Annual Symposium: You Veterinarian and Your Dog

17th Annual Symposium



The Canine Genetic Disease Information System

The first speaker, Dr. Donald F. Patterson, Charlotte Newton Sheppard Professor of Medicine, and Chief, Section of Medical Genetics, discussed the Canine Genetic Disease Information System (CGDIS). He pointed out that genetic defects now are perceived as an important medical problem by the general public. "The advances in vaccine development, nutrition, and new methods of dealing with parasitism over the last three decades have largely eliminated severe illness due to infectious and debilitating diseases in man and animals," he said. "As a result, there has been a gradual shift in the nature of health problems, away from those that are due to causes extrinsic to man and animal and toward those that are to a large extent genetic in origin."

To date, more than 200 genetic diseases of dogs have been described in the literature. Diseases that have a major genetic component include a large variety of congenital malformations (cleft palate, hernias, heart defects), abnormalities in growth and development (hip dysplasia, cryptorchidism), endocrine diseases (diabetes, hypothyroidism), and progressive degenerative disorders (progressive retinal atrophy, cerebellar atrophy). A rapidly expanding number of metabolic diseases are being recognized (mucopolysaccharidosis, copper storage). Inherited deficiencies in the immune system are now known to cause some dogs to have increased susceptibility to infectious diseases. A genetic component has been recognized in certain forms of cancer (osteosarcoma, mastocytoma), and in a number of degenerative disorders associated with aging (intervertebral disc disease, chronic valvular heart disease).

The variety of dog breeds is tremendous; no other mammalian species shows such diversity. Differences between breeds are genetic, due to selection for various features and qualities. Each breed of dogs represents a genetic isolate, a group of individuals sharing a specific gene pool; and each breed tends to have its own genetic diseases. In selecting for specific breed characteristics, man unwittingly selected also for genes which interfere with proper development in each breed.

Currently, new genetic diseases are recognized and reported every month, and the rate of discovery is accelerating, due to an increasing sophistication of

The Seventeenth Annual Symposium, Your Veterinarian and Your Dog, was held on January 31, 1987, at VHUP. Following are the summaries of the talks and discussions.

diagnostic methods in veterinary medicine. Many more genetic diseases are known or suspected by breeders and veterinarians but are not sufficiently well-studied to be reported in publications. As information continues to accumulate, dog breeders, breed organizations, and veterinarians will have an increasing need for a comprehensive source of information regarding the genetic defects that have been proven to occur in each breed, including their diagnostic features and their modes of inheritance. Also needed is information regarding defects that are strongly suspected but not yet proven to have a genetic basis. Evidence of this kind can serve as a valuable "early warning system" which could be used to alert breeders to an emerging genetic problem.

In the past, compilations of genetic disorders have been made, but they are too limited in scope and cannot be kept current enough to satisfy the present needs of dog breeders and veterinarians. It has become apparent that the expanding body of available information cannot be efficiently organized, kept up-to-date month by month, and made accessible by any system now available. A new method, using modern computer technology, is needed. Computerized access allows the user to answer questions of greater variety and complexity with increased speed and permits the inclusion of additional information as new knowledge evolves. A system of this type will have a number of important benefits to the purebred dog world:

1. It will provide a compendium of current information that can be used by owners, breeders, and national breed clubs to keep track of known and suspected genetic disorders within each breed on a month-to-month basis. If national breed clubs con-

tribute information to the system as well as obtain information from it, the system can serve as a focus around which genetic committees can organize their activities and become more effective.

2. It will create, for the first time, a truly current and comprehensive source of information to help veterinarians recognize the genetic diseases that occur in each of the breeds. This will improve the accuracy of diagnosis and lead to more effective treatment.

3. By providing current information regarding modes of inheritance and tests for the recognition of carriers, the system will assist breeders and veterinarians in developing programs to reduce the frequency of genetic diseases in purebred dogs.

The Section of Medical Genetics, School of Veterinary Medicine, University of Pennsylvania, is developing a comprehensive system that will make up-to-date information on genetic disorders of the dog readily available to breed clubs, breeders, and veterinarians. This project has been made possible by a grant from the American Kennel Club. The CGDIS



Mr. Charles A. T. O'Neill of the American Kennel Club, Mrs. Patricia L. Green, and Dr. Donald F. Patterson at the computer for the Canine Genetic Disease Information System.



Syndrome of Short-Limbed Dwarfism with Ocular Defects in Samoyeds

This is a recessively-inherited defect in the development of the bones. Affected dogs have short legs, outwardly deviated front paws, and defects of the retina and lens of the eye. (Photo reprinted from JAVMA, Vol. 183, No. 9, November 1, 1983)

will be computer-based, using microcomputer capability. The software and information base being developed by the Section of Medical Genetics can be utilized directly by veterinarians, breed organizations, and others with interest in genetic defects of the dog. To make it available to the largest number of users, the program is written for the IBM-PC and compatible machines. Users will be able to obtain updated versions of the information base at intervals. The system will be continually updated on a monthly basis. Information will be gathered from the published literature, research workers, practicing veterinarians, veterinary institutions, breed clubs and breeders, as well as our own genetics clinic.

A monthly survey of scientific journals and breed club publications in this country and abroad will be used to keep the data base current. We also propose to establish a network of veterinary institutions and breed club genetics committees which will provide an additional source of evidence regarding previously undocumented genetic defects. The institutions will include the veterinary schools in this country, and other large teaching hospitals. In some cases, practicing veterinarians will provide information. The genetics committees of the national breed clubs will be encouraged to submit information.

The information will be gathered, extracted, and entered into the computerized system by a coordinator, after review by members of the Section of Veterinary Medical Genetics. The professional personnel involved in the project are: Dr. Donald F. Patterson, project director; Dr. Gustavo A. Aguirre, professor of ophthalmology in medical genetics; Dr. J. C. Fyfe, resident in genetics; Dr. Urs Giger, assistant professor of medicine in medical genetics; Patricia L. Green, project coordinator and bibliographer; Dr. Mark E. Haskins, associate professor of pathology and medical genetics; Dr. Peter F. Jezyk, adjunct associate professor of medicine in medical genetics; Dr. Vicki Meyers-Wallen, assistant professor of

reproduction in medical genetics; Dr. Stephen P. Schiffer, assistant professor of laboratory animal medicine and medical genetics.

The system will contain the following information: name of each genetic disorder and common synonyms; breeds affected; status as to whether established or suspected; system or systems of the body involved; diagnostic features, including age of onset, physical signs, laboratory test findings, and pathology; mode of inheritance; tests for the recognition of carriers of recessively inherited diseases; recommendations for control of the disorder (genetic counseling); references to sources of available information; names and addresses of individuals and laboratories providing special expertise or tests for specific disorders.

The system will contain no information about the identity of specific animals or their owners.

The computer program for CGDIS has been under development for more than a year and the initial version is now nearing completion. The program is designed to be user-friendly and will allow display and printout of information in a variety of formats. Breeders and veterinarians will be able to query the system and obtain information pertaining to currently known or suspected genetic defects in a breed. Diagnostic criteria will be provided as well as age of onset, physical signs, laboratory tests, and mode of inheritance. Veterinarians can use it as a diagnostic aid by listing a specific set of clinical signs and symptoms, and by requesting a list of genetic disorders responsible for such signs. Laboratories performing special tests for specific genetic disorders or carrier detection will be listed. Also principles of genetic counseling for each specific disorder will be provided. In addition, the system can furnish a list of breeds in which a specific genetic disorder occurs. It can also list genetic disorders with a particular diag-



Lethal Acrodermatitis in Bull Terriers

This is a recessively-inherited defect which is first noted as retarded growth and difficulty in eating. Skin lesions develop around the eyes, ears and mouth, and on the feet, and the footpads become hard. The toes are splayed. Affected pups are very susceptible to infection and usually have repeated infections. We believe this to be an inherited defect in zinc metabolism, since the clinical picture and the pathology are identical to zinc deficiency. However, the pups were all fed a diet adequate in zinc content, and zinc treatments do not cure the disease. There is apparently some "block" in the metabolism of zinc which prevents the body from using it. (Photo reprinted from JAVMA, Vol. 188, No. 8, April 15, 1986)

nostic feature, and it can provide literature references and other sources of information regarding any genetic disorder.

It is anticipated that the first version of the CGDIS will be available during 1988 for use and testing by other institutions and breed organizations. Once the system is fully developed, it can serve as an immediate source of information by answering direct inquiries from breeders, breed clubs, and veterinarians. Further, periodic written reports to the American Kennel Club, breed organizations, and the veterinary profession can be provided. It is anticipated that the software and current information base will be made available as a package. The data base will be maintained and updated by the University of Pennsylvania, but other institutions will be encouraged to obtain the software and information base for use locally. That way regional information centers can evolve.

The long-term goal is to encourage the development of a comprehensive program that can be used throughout the United States and abroad to recognize and control genetic disorders in purebred dogs. By cataloging and making available the burgeoning knowledge on the known and suspected genetic disorders in each breed and by stimulating the cooperation of veterinarians and dog breeders in the collection of this information, the stage will be set for the next step, which is to establish comprehensive certification for genetic diseases. A program of comprehensive certification will use the CGDIS as the source of information needed to specify which examinations and laboratory tests are necessary to recognize all of the known and suspected genetic disorders within each breed. Breeding animals could be taken to a veterinary institution and tested for the known genetic defects of that breed. Breeders would not have to take their animals to a number of specialists in different locations. But such certification program is still in the future.

Dr. Patterson then briefly discussed subaortic stenosis, a genetic disorder emerging in the golden retriever. This disease also occurs in the Newfoundland and has been studied extensively in this breed. The disease affects the heart and can cause sudden death due to arrhythmia. It is inherited, apparently through a dominant gene with modifiers. This causes varying expression of the disorder; some animals are hardly affected while others may show symptoms early in life. He pointed out that, once CGDIS is in place, emerging problems in a breed, such as SAS in goldens, can be made known more quickly to veterinarians and breeders. This would lead to earlier testing of future breeding stock and the prevention of the spread of a newly identified genetic disorder.

He then touched on inbreeding, frequently blamed by the popular press for problems in purebred dogs. Dr. Patterson pointed out that inbreeding, the mating of closely related animals, in itself, does not produce defects. Rather, it brings out the defective genes carried by the animals. "Inbreeding is necessary to fix certain genetic traits, but when inbreeding is practiced it is important to realize that hidden genes for genetic defects will become apparent. Of inbred animals, only the best should be retained for breeding."

During the question and answer period he also stated the importance of keeping accurate records to monitor problems and progress in a breeding program. "When trouble occurs, you can refer back," he said. "You may be able to detect a pattern and then something can be done about it before it becomes too widespread." He expressed the hope that the CGDIS will stimulate a dialogue among breeders and that it will facilitate the control of genetic diseases in purebred dogs.



Canine Reproductive Problems

Dr. Vicki Meyers-Wallen discussed canine reproductive problems in the bitch and dog and how they can be recognized, treated, and prevented.

On the average, bitches cycle every seven months and the reproductive cycle can be divided into anestrus; proestrus; estrus; pregnancy; preimplantation period, period of the embryo, period of the fetus; whelping; and lactation. Problems can occur at all stages and the veterinarian must know at what stage the problem is occurring in order to approach it in a rational manner. An important step in preventing and recognizing problems is good record keeping.

Anestrus is a period of reproductive quiescence. Toward the end of this period, hormonal changes occur internally which prepare the bitch to come into season. Bitches that fail to cycle may have problems unrelated to the reproductive system such as hypothyroidism, Cushing's disease, liver or kidney ailments, or other major illnesses which prevent the initiation of a normal cycle.

Proestrus marks the period when external signs such as vaginal swelling and bleeding occur. However, some bitches may cycle but do not present any external signs. The problem can be circumvented by good records and then taking weekly vaginal smears during the period that proestrus is most likely to occur.

Estrus is a very important stage since ovulation occurs during this period. The most frequent problem during this period is that sperm are not present in the oviduct during the periovulatory period, so fertilization does not occur. Good breeding management is essential to correct this. Failure of ovulation is less common. It can be documented by serum progesterone determinations. Abnormal anatomy which prevents the union of sperm and eggs can also occur. This includes the obvious vaginal stricture which is painful and prevents a "tie," and the less obvious abnormalities where part of the uterus or oviducts may be missing, obstructed, or infected, thus preventing the sperm from reaching the eggs in the oviduct, where fertilization normally occurs. Vaginal strictures can be removed surgically. Usually such bitches whelp normally, though one should be prepared for a C-section.

To pinpoint the best days to breed a bitch, vaginal smears should be done, beginning in proestrus and all the way to diestrus. The vaginal cytology changes and, when a bitch is ready to breed, cells will be 90 percent or more cornified. Breeding should be done every other day until diestrus becomes evident in the smear. Dr. Meyers-Wallen explained that the first-day-of-diestrus vaginal smear provides a valuable clue as to when ovulation occurred. Bitches ovulate six days prior to diestrus, and there is a "golden period" when the conception rate is high. It is from 10 to 4 days prior to the onset of diestrus. Studies have shown that bitches bred during this period had a good conception rate and good litter sizes. She pointed out that if a bitch bred in this period misses, then management is unlikely to be the problem and one must look for other causes. Knowing the first day of diestrus also makes the calculation of the whelping date easier. Generally bitches whelp 57 days from that date.

The period of pregnancy is divided into three phases: preimplantation period, period of the embryo, and period of the fetus. During the first phase, which lasts 19 days, the fertilized eggs float in the uterine horns and then attach to the walls. In the next period (19-35 days), organ systems are formed

and the placenta is in place. If the bitch suffers an insult, such as infections, exposure to toxin, etc., fetal deaths can occur and the embryos are resorbed. During the final period, 35 days to birth, the fetus continues to grow. If a fetal death occurs, the fetus will be expelled. Hormonal abnormalities of the bitch and infections of the bitch or fetus are the best known causes of fetal death during this period. Abortion due to *Brucella canis* occurs most often during this time. Routine prebreeding tests of the bitch and stud are recommended to prevent the spread of *Brucella canis*.

Dr. Meyers-Wallen also pointed out the importance of early pregnancy diagnosis. It can be diagnosed by palpation at 28 days and by ultrasonography at 21 days from the first breeding. Routine early pregnancy confirmation is recommended to differentiate between failure of fertilization and embryonic death, since the causes of these two problems may be quite different.

She emphasized the importance of records and recommended that a chart be kept on each breeding bitch. On it the breeder should note the results and date of brucella tests, the date of the beginning of proestrus, estrus and diestrus, breeding dates, palpation date, whelping date, number of puppies, living and dead, and problems encountered. Such records can be a valuable reference in case of problems at a later date, and it can help the veterinarian to determine a treatment to correct a problem.



Sperm with coiled tails



Late Proestrus Vaginal Cells



Estrus Vaginal Cell

A stud dog is an important part of a breeding program, and Dr. Meyers-Wallen emphasized that the male chosen should have superior breed characteristics and should be anatomically normal. He should be free from inherited defects. She recommended that a reproductive evaluation be done soon after puberty, at the age of 10 to 12 months. Such evaluation includes: examination of the reproductive system, behavioral evaluation, and complete semen evaluation.

Examination of the reproductive system should be performed by a veterinarian to be certain that the breeding apparatus is normal. For the behavioral evaluation the young male is introduced to a friendly, estrus bitch in the usual breeding setting every 1-2 weeks if possible. It is not necessary that he actually breed; just give him time to figure out what he is there for. Observe his behavior; he should become more interested and less intimidated with each encounter. He should be easy to handle at all times and not allowed to become aggressive with the bitch or the people handling him. When he begins mounting behavior, he may be ready for his first semen collection.

This collection and the subsequent evaluation should be done by a veterinarian. The semen evaluation includes: measurement of volume, motility, sperm count per ejaculate, and sperm morphology to determine whether the sperm is normal. It is important to remember that the sex drive usually precedes sperm production. If the first collection is not so good, one should wait two months before the semen is evaluated again.

Once semen evaluation is normal, the dog should be allowed to breed naturally to an experienced friendly estrus bitch. If he is to be collected in the

future for artificial insemination or frozen semen, it may be good to occasionally collect him so that he is used to the procedure. This may be best attempted on later breedings, not on his first breeding. Breeders should be sure that the dog is not traumatized by the experience, since he may not forget the experience and become difficult to breed. If the dog is timid, more time should be allowed or a different bitch used.

Good records are essential if problems are to be identified at an early stage. Every breeding should be recorded: bitch, her age, dates of breedings and whether they were inside ties or artificial inseminations. The date of whelping and the number of puppies should be recorded, as well as the bitch which did not conceive. *Brucella canis* tests should be recorded as well as the results of the semen evaluation.

Dr. Meyers-Wallen pointed out that a 75 percent whelping rate is accepted as being within normal expectations. If the dog's rate is below that, he should be evaluated. If his rate is greater but he misses two or three bitches in a row, he should also be evaluated. The number of pups per litter is also useful in that a decrease in litter size can be the first indication that the sperm numbers are decreased. Early detection may prevent irreparable damage to the stud's breeding capacity.

She explained that it takes 54 days for sperm to develop. If germ cells have suffered an insult, such as infection, it will not be evident for quite awhile. She

said that stud dog owners should recommend that bitches be checked early for pregnancy. If a problem is suspected with the dog, then action can be taken earlier than if one waits until the whelping date.

Vaginal smears of the bitch provide a good guide for the proper breeding date, and the stud dog owner should have such smears performed while the bitch is in his/her care.

Dogs which are used frequently should be tested for *Brucella canis* twice a year. A semen evaluation should be done annually. Dogs that have not been used for awhile should also be evaluated prior to breeding.

During the question and answer period it was asked whether the thyroid status is related to reproductive problems. Dr. Meyers-Wallen indicated that, theoretically, hypothyroidism could be responsible for reproductive problems. She cautioned that thyroid replacement drugs should not be given without prior testing. The most accurate test is the TSH test, which measures the function of the gland. Resting levels of T3 and T4 often do not give an accurate result as the values are subject to interpretation.

The question of vaccinating a bitch during pregnancy was raised. Dr. Meyers-Wallen indicated that it is best to vaccinate prior to breeding to get maximum protection for the puppies. False pregnancies should be regarded as normal, as the bitch has a high level of progesterone after estrus, regardless of whether she is pregnant or not.

Dr. Meyers-Wallen stressed the importance of working closely with the veterinarian and the importance of detailed records.

Dr. Vicki Meyers-Wallen is assistant professor of reproduction in medical genetics at the School.



Rabies Update

Dr. Lawrence T. Glickman, associate professor of epidemiology and Chief, Section of Epidemiology, discussed the recent rapid increase in the number of rabies cases in Pennsylvania.

Rabies is a fatal viral disease affecting the central nervous system. It is transmitted through the bite from a rabid animal. The disease can affect all warm-blooded animals, including man. The number of cases seen in wildlife, dogs, cats, and livestock in Virginia, Maryland, and Pennsylvania has increased dramatically during the last seven years. Pennsylvania now has a mandatory rabies vaccination law for dogs and cats. Such vaccination decreases the chances of human exposure to the disease, as vaccinated animals act as a buffer between humans and wildlife.

Many of the new vaccines for cats and dogs are effective for three years; then a booster is needed. An exception is the young animal vaccinated under one year of age that requires a booster at age one and then three years later. At this point there is no vaccine for wildlife, though several researchers are developing such a product.



Dr. Glickman showed a film which illustrated the symptoms of rabies in animals. Contrary to folklore, rabid animals frequently do not become violent or furious. The infection often follows a pattern. The incubation period varies typically from 15 to 50 days after the bite, during which there are no clinical signs. In some cases it may last longer. During the prodromal phase, the animal shows subtle behavioral changes. During the next phase, of excitation, there is usually a more pronounced change in behavior. The animal will be restless, excitable, and it may attack without provocation. It will also lose fear of natural enemies. Animals in this furious stage will eat foreign objects such as stones, straw, and wood; and rabid dogs in this phase will often chew on the

wire and frame of their cages. Paralysis may accompany the behavioral changes or occur by itself. In some animals the excitatory phase may be quite short in duration with a longer paralytic phase.

Any animal suspected of being rabid should be destroyed, taking special care that the head is preserved. The brain is needed for laboratory tests to determine whether the animal indeed was rabid.

Dr. Glickman explained that wild animals, such as raccoons, should not be brought into a household as pets as they are natural reservoirs of rabies. He also warned against hand raising very young raccoons. He advised that if wildlife is observed exhibiting out-of-character behavior, the game warden should be contacted at once. Under no circumstances should one go near such an animal. He feels that vaccination of the general cat and dog population offers the greatest degree of protection to humans, as it reduces the chance of human contact with a rabid pet.

Should one come into contact with a rabid animal such as a bat or other wildlife, a physician should be seen at once so that protective measures can be instituted. There is now a human rabies vaccine which can be administered subcutaneously; it is safe and painless and offers good protection.

Feeding Programs for Problem Dogs

Dr. Susan Donoghue, assistant professor of nutrition, discussed the feeding of problem dogs. She pointed out that for most dogs the nutrient requirements are quite broad and that dogs tolerate a range of foods without problems. The requirements, however, become narrow when one deals with a dog under stress. Such stress may be due to illness, pregnancy or lactation, growth, hard work, or extreme weather conditions. At these times it is vital that the proportions of essential nutrients in the food are correct and available to the animal in the proper amounts.

Dog food is manufactured dry, canned, or semi-moist. The dry foods can be kibbled, expanded, and dense-dry. Most dry foods are cereal-based; they have a varying content of meat, meat by-products, and fiber. Canned food, too, can be cereal-based with little meat. It is important that consumers read the label to determine the ingredients. Main ingredients are listed first, and these are in the food to provide energy and protein. One should also look to see whether the food meets NRC requirements or whether it has passed AAFCO tests.

There is quite a variance between dog foods. Generally, the high-dense foods are better utilized by the dog. They are more digestible and higher in protein content. Dog owners can evaluate the digestibility by looking at the stools. If they are dark and dense, then the dog is utilizing the food well. If they are loose and large in quantity, the digestibility leaves something to be desired.

In order to be of benefit, all the nutrients, vitamins, and minerals in the food should be available to the dog in correct proportions. Unfortunately, this is not always the case; vitamins are lost during processing and storage. Preservatives may interfere, and long-term antibiotic or anti-convulsant therapy can also interfere with utilization of vitamins. Dog food companies try to guard against such losses by adding supplements in such an amount that processing losses can be compensated for. Supplements given by owners may also interfere with the proper utilization of vitamins and minerals. Often animals can become

quite ill because of improper supplementation.

Commercially available dog food can be improved and made more palatable to the dog. The addition of water alone to dry, expanded foods will increase food intake by 10 to 20 percent. Milk is an excellent supplement which will enhance the fat and protein content. However, it should be introduced slowly to give the dog's system a chance to adjust to it. Once a dog is accustomed to milk, it can be fed safely. Fat or oil can be added to boost the energy content, but this has to be done with care. Too much fat introduced suddenly cannot be adequately digested. It also may overwhelm the pancreas. Further, it enhances palatability and the dog may overeat. When fat or oil is added, it should be in moderate amounts.

One can increase the protein content of dog food by adding cottage cheese, which contains high quality protein. Cheese and eggs are also excellent protein sources. Meat can be added; it is high in protein and allows a better utilization of amino acids.

Home cooking is another excellent way of giving the dog a good ration. Recipes are given on the following page. When preparing home cooked foods, it is essential that the list of ingredients and instructions is adhered to. One cannot, for example, substitute ground limestone for bone meal, or use noodles instead of rice. The proportions of the various ingredients in these recipes are carefully worked out to provide optimal intake of food energy. Dr. Donoghue explained that minute rice cannot be substituted for white or brown rice measure per measure. If substitutions are made, the ingredient chart must be consulted and substances should be exchanged on a caloric or protein basis.

She emphasized the importance of regularly monitoring the dog's body weight and condition. Dogs should be bright and alert, and about 1/8 inch of flesh should cover the ribs. One should be able to feel the ribs easily, but they should not stick out. Dogs, like people, are not all the same. Animals of the same size often need different amounts of food to keep in top shape. There can be as much as a 20 percent variation in caloric needs between animals. Thus, a frequent check of individual dogs is important.

Animals out in the cold weather or hard working, such as prolonged hunting or racing, require more

calories and protein. Bitches in late gestation and early lactation also need more energy and protein. This is best done by increasing the protein and fat content with meat-based feed rather than by adding cereal feed.

Dogs also can get too fat. An English study showed that about 20 percent of the dogs seen by veterinarians were obese and 3 percent were grossly obese. The figures are about the same at VHUP. Dr. Donoghue explained that prior to putting a dog on a reducing diet, it should be checked by the veterinarian to be sure that no underlying disease is present. When formulating a reducing diet, one must think in terms of calories and the balance of the individual ingredients.

Dr. Donoghue discussed dogs with frequent bouts of gastritis and said that a low-fiber, low-fat diet may be helpful. She recommended rice as the most digestible carbohydrate, along with lean meat and the proper supplement package. Older dogs present a larger number in the population. Their dietary needs are special. Dr. Donoghue feels that they should be fed a high-protein diet, similar to puppy food or a dense-dry food, to meet their needs. She advised against very low-protein, geriatric diets available in the market.

During the question and answer period she explained that when weaning puppies the food should closely approximate the content of the bitch's milk and be high in protein. She recommended a creep-feeding program where the pups have access to the food away from the bitch. As they get used to it, they can be gradually changed over to a high quality puppy food.

Dr. Donoghue advised against supplementation with kelp, as the seaweed generally available in stores comes from many different sources. Often the iodine content is very high and one can get toxic levels. Veterinarians have seen problems in foals from mares which had been fed kelp. These foals were born with goiters. Also, some kelp may contain high quantities of heavy metals.

Dr. Donoghue reiterated the importance of a proper diet for dogs, tailored to their needs. One must pay attention to the individual dog when formulating a diet and consider whether it is lying around the house or whether it is a dog under stress.





Maintenance* Energy Requirements

Body Weight		Kcal/Day
kg	lb	
1	2	132
3	6.5	301
5	11	441
10	22	742
20	44	1248
30	66	1692
40	88	2099
50	110	2482
60	132	2846

*Maintenance refers to a healthy dog that is not growing, pregnant, lactating or stressed, and is living in comfortable surroundings.

Home-Cooking Diets

The diets shown below have been formulated and developed by Dr. D. S. Kronfeld, University of Pennsylvania, and are reprinted here with his permission.

1. Maintenance Diet

Ingredients:

- 2/3 cup rice, uncooked
- 1/3 cup meat (beef, pork, lamb, boneless poultry, or boneless fish)
- 1/8 cup (= 1 oz) liver
- 3 teaspoons bone meal
- 2 teaspoons corn oil
- 1/2 teaspoon iodized salt

Cooking Instructions: Place rice, bone meal, corn oil, and iodized salt in 2/3 to 1 cup boiling water. Stir, cover, and simmer 20 minutes. Add meat and liver, stir, cover, and simmer 10 minutes. Cool.

Feeding Instructions: The amount of diet shown above provides 800 kcal. This is a sufficient daily intake for a 10 kg (about 23 lb) dog. The diet should be fed in at least 2 *divided* feedings.

2. Bland/Hypoallergenic Diet

- Use lamb (trim excess fat) or skinless poultry as source of meat.
- Use chicken as source of liver.

SOME COMMON DIET INGREDIENTS

Food	Unit	Grams	Water %	Kcal	Protein	Fat	CHO
					----- % ME -----		
Cottage Cheese, 4% lg curd	1 cup	225	79	226	50	40	10
1%	1 cup	226	82	154	73	12	16
Cheddar Cheese	1 oz	28	37	115	26	74	tr
Milk, 3.3%	1 cup	244	88	148	22	49	30
2%	1 cup	244	89	125	26	36	38
1%	1 cup	244	90	107	30	25	45
Ice Cream	1 cup	133	61	270	7	47	47
Yogurt, plain	8 oz.	227	85	145	33	25	44
Egg, whole large, raw	1 egg	50	75	82	29	66	5
scrambled	1 egg	64	76	91	26	69	4
Corn Oil	1 tbs	14	0	126	0	100	0
Sardines, canned in oil	3 oz	85	62	161	50	50	0
Steak, round lean & fat	3 oz	85	55	213	45	55	0
Heart, beef	3 oz	85	61	157	69	29	3
Liver, beef	3 oz	85	56	189	47	43	11
Chicken, broiled	6.2 oz	176	71	231	73	27	0
canned	3 oz	85	65	162	44	56	0
Turkey, chopped	1 cup	140	61	257	68	32	0
Rice, instant, cooked	1 cup	165	73	176	9	tr	91
long grain, cooked	1 cup	205	73	216	7	tr	93
raw	1 cup	185	12	653	7	1	91
Spaghetti, cooked	1 cup	130	64	193	15	5	81

3. "High" Protein and "High" Fat Diet

Use 1/3 cup rice and 2/3 cup meat.

NOTE: ALL OTHER INGREDIENTS REMAIN AS ABOVE.

NOTE: This diet still contains 800 kcal. Only the proportions of carbohydrate, fat, and protein have changed.

4. Low Fat Diet

Use skinless poultry or very lean meat (e.g., beef heart) as meat source.

NOTE: Do not reduce corn oil; it provides essential fatty acids.

NOTE: This diet still contains 800 kcal. Only the proportions of carbohydrates, fat, and protein have changed.

NOTE: These diets should not substitute for a visit with your veterinarian. The diets, and further variations, have best results when used under the supervision of a veterinarian.

Arthroscopy in Horses

The operating room at New Bolton's C. Mahlon Kline Center is quite dark, the only source of light being a television screen which shows the interior of a joint. A group of students listens attentively as the surgeon explains the TV image and the procedure he is about to do. The patient, a horse, lies quietly in anesthetic sleep. Arthroscopic surgery is being performed. This scene, unthinkable six or seven years ago, happens almost daily at New Bolton Center and at other veterinary hospitals.

"Arthroscopy now is a routine procedure when a horse with a joint injury is presented," said Dr. Dean Richardson, assistant professor of surgery at the University of Pennsylvania School of Veterinary Medicine. "It is one of the greatest advances in orthopedic surgery." The arthroscope, a relatively new instrument, was developed in its modern form in the 1950s. Human orthopedics adopted it widely as a diagnostic tool in the mid-seventies, and it was soon utilized in veterinary medicine. Beginning in 1981, it was used for orthopedic surgery in large animals. New Bolton Center began using the arthroscope on clinical cases in 1982, and now about 200 arthroscopies a year are performed here. Prior to the devel-

opment of the instrument, major surgery was necessary to remove chips or debris from a joint. The joint had to be opened widely, involving more trauma to the surrounding tissues. Also, this procedure required a lengthy recovery time.

An arthroscope is a slender optical instrument that permits the surgeon to look into the joint without opening it, and to remove small chips and other debris. "The joint can be accurately examined through a small incision," said Dr. Richardson. "Lesions and conditions not detectable by radiographs can be seen. The procedure is not as traumatic as an arthrotomy and the recovery time is quicker."

The arthroscope is inserted through a protective, rigid small tube or canula. Fiberoptics within the arthroscope permit illumination of the joint interior, and a camera attached to the instrument allows the clinician to examine the interior of the joint. The lens is at an angle so that rotation of the scope permits a wider area of visualization. The incision for the arthroscope is very small, as the instrument is only four millimeters in diameter. When arthroscopy is performed, the joint is kept filled with a sterile fluid to keep the soft tissues from collapsing into the joint space. The fluid runs constantly to keep the

space clean of blood and to maintain distension of the joint. When instruments are used, they are inserted through a second small incision. These instruments are specially designed with long, narrow shanks. They can be manipulated in the tight joint space under arthroscopic visualization. The surgeon needs bimanual dexterity and has to be trained in the interior anatomy of the joints. "With the arthroscope you get a more complete view than in open joint surgery," said Dr. Richardson. "Also, you can manipulate the joint and get different views to help evaluate the extent of the damage."

"We use it for both diagnosis and treatment," said Dr. Richardson. "Infected joints can be examined and flushed out, bone chips or damaged cartilage can be removed, and one can examine multiple joints while the animal is anesthetized a single time." He explained that the joints most often examined are the carpal joints, the fetlock, and hock and stifle joints. The stifle and hock joints, in particular, are prone to osteochondritis dissecans lesions, and these cartilage chips cause lameness. Although the majority of horses undergoing the procedure have a specific problem identified before surgery, the arthroscope can be an invaluable tool in identifying the source of lameness when other means such as radio-