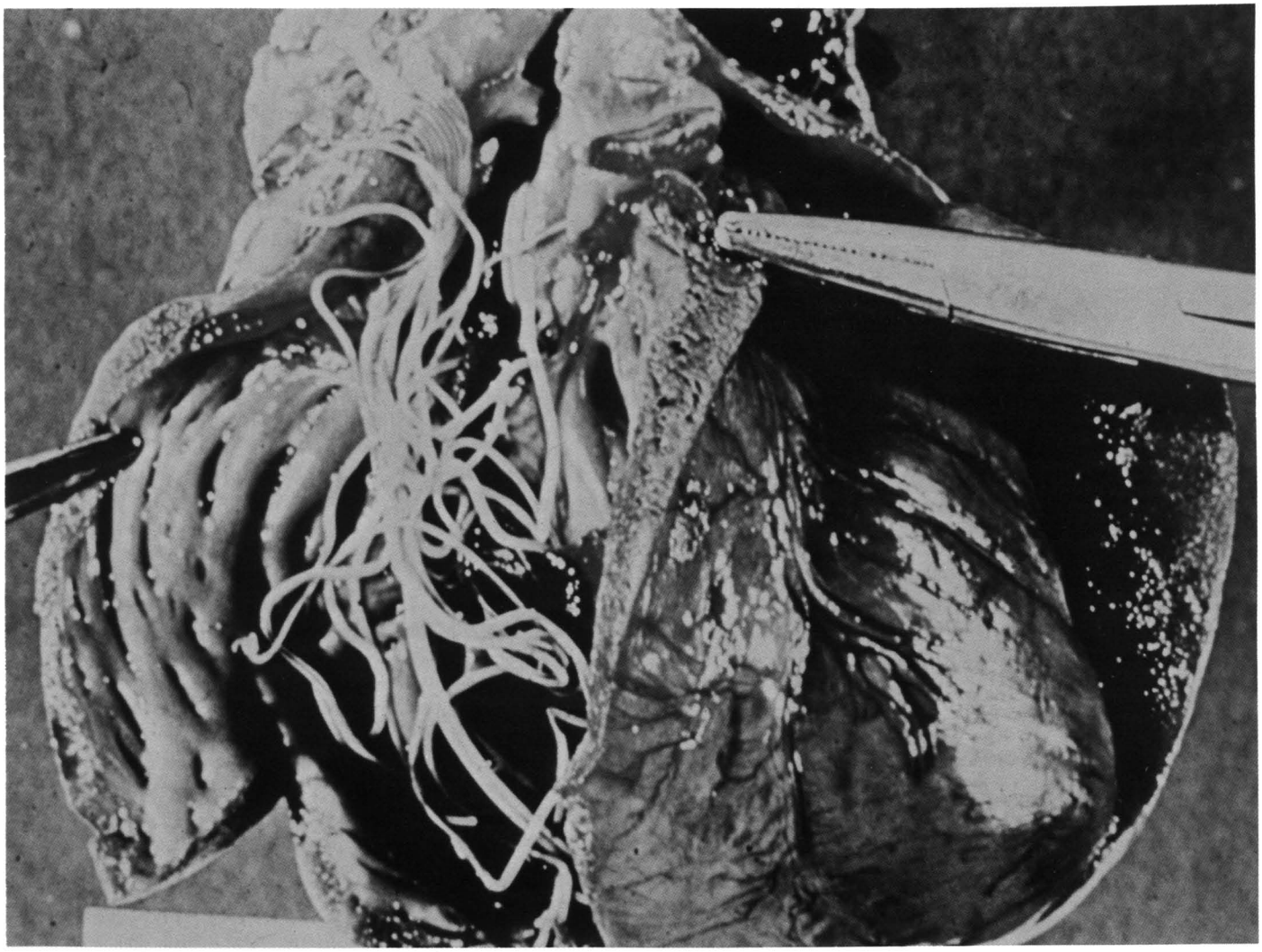
Veterinary Medical Review

College of Veterinary Medicine and UMC Extension Division



University of Missouri-Columbia

March, 1976, No. 93

That pesky mosquito causes disease. See heartworm and encephalitis stories in this issue.

With the mosquito comes canine heartworm

by Dr. John D. Rhoades, Urban Extension Veterinarian

As spring and summer approach, bringing the mosquito, the incidence of exposure to canine heartworm increases and veterinarians begin preventive treatment programs. Practitioners are also checking for the previous season's exposure by examining blood samples for microfilariae.

The geographic distribution of the nematode *Dirofilaria immitis* or canine heartworm is cosmopolitan. The parasite is reported to be widespread in dogs and various wild carnivores throughout the world.

Human dirofilariasis has been reported but man is considered to be an unsuitable host. The parasite apparently cannot complete its life cycle and produce microfilaria in the human.

The nematode also occurs in domestic cats. However, the true incidence in the feline is unknown. Microfilaremia has been reported to occur in only about 18% of infected cats. This probably eliminates the cat as a serious reservoir for the parasite.

Although as least 11 different species of filarial parasites have been reported in dogs from various regions of the world, only two are considered to be of any importance in the United States. In addition to *Dirofilaria immitis, Dipetalonema reconditum,* a flea-transmitted filarial worm that lives harmlessly in subcutaneous tissue, is commonly found in the dog in the United States. Although *Dipetalonema* is not considered to cause serious disease, the presence of microfilariae from this nematode does tend to confuse the diagnostic picture.

Diagnosis

In 1974, 21% of the cases positive for microfilariae at the Veterinary Teaching Hospital at UMC were determined to be *Dipetalonema.* Thus due to the seriousness of heartworm disease and due to risk incurred in treatment, accurate diagnosis is necessary. In areas where *Dipetalonema* is commonly enzootic a differential diagnosis is mandatory.

The method of blood collection from the dog varies with the technique used for demonstration of the microfilariae. The blood sample may be taken into a heparinized syringe, into EDTA, or directly into a lysing solution. The time of collection is not considered important as microfilariae are present in the peripheral blood at all times during the day. Reexamination of additional samples of suspected clinical cases is advised if microfilariae are not found in the first sample.

For best results blood samples should be examined for microfilariae as soon after collection as possible. If the sample is allowed to stand at room temperature, the microfilariae tend to increase in size and if stored in formalin, they tend to shrink.

There are two methods of demonstration of microfilariae in a blood sample. The oldest method is a nonconcentration technique of microscopically screening a drop of blood for the presence of microfilariae. The second nonconcentration method is the microscopic examination of the area of the buffy coat portion of a standard 75 mm heparinized capillary tube that has been filled with blood, sealed and centrifuged in a microhematocrit centrifuge for 4-5 minutes.

Only a small sample of blood is examined with the nonconcentration methods and they are useful only to determine if the sample is positive or negative. Further methods have to be used for specific parasite identification of positive samples.

The concentration methods of blood examination are the most practical means for detection and preparation of samples for morphological differentiation between the different microfilarial species. The concentration methods currently in use are the modified Knott's test and the millipore filtration method. The modified Knott's method (Fig. 1) allows for concentration, fixing and staining of the microfilariae for accurate identification. It is a rapid and inexpensive method of microfilaria demonstration.

There are several commercial millipore filtration tests available. They involve the concentration of microfilariae by passage of lysed blood through an 8-micron millipore filter. The microfilariae are concentrated on the millipore filter, stained and examined microscopically.

The modified Knott's test and the millipore filter technique continue to be the most reliable microfilaria detection methods currently in use. These methods have been stated to have an 85-90% or higher detection and differentiation rate.

The differential diagnostic features (Fig. 2) were originally described by Newton and Wright in 1956 and later confirmed by Lindsey in 1961. These criteria are still used for differentiating filarial parasites in the canine.

In addition to those criteria listed in Figure 2, *Dirofilaria immitis* microfilariae have been observed to move with a random undulating movement on a wet mount direct smear while *Dipetalonema* have generally been observed to move in a straight line.

Serological procedures have been used but to date have not been perfected well enough to be a practical aid in diagnosis or differential diagnosis. Skin tests, hemagglutinin complement fixation, precipitation and fluorescent-antibody tests have all been used.

Dirofilaria immitis has four larval stages, two of which develop in the mosquito and two in the canine host (the adult stage and the microfilaria stage). Each of these stages may serve as different antigens, thus the host response may be different to the various stages.

A histochemical test and staining procedure utilizing acid phosphatase-enzyme activity in microfilariae of the species *Dipetalonema* and *Dirofilaria* is highly accurate in differentiation between the two species. The acid phosphatase activity is restricted to two distinct bands of red azo dye in the microfilariae of *Dirofilaria.* The microfilariae of *Dipetalonema* are stained uniformly bright red posterior to the excretory pore. Although highly accurate in differentiation and identification of the two species, the method is time consuming and impractical except as a research tool.

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Figure 1. MODIFIED KNOTT'S METHOD

1. Mix 1 ml blood with 9 ml 2% formalin. (The blood should have no anticoagulant.)
2. Centrifuge for 5-8 minutes at 1500 RPM.
3. Pour off supernatant fluids; touch mouth of tube to clean paper towel.
4. Place one drop of sediment on slide; add a drop of 1:1000 aqueous methylene blue and mix. (Methylene blue may be added to sediment while still in centrifuge tube.)
5. Place coverslip on drop on slide.
6. Observe microscopically. Measure width and length of several microfilariae.

Figure 2. DIFFERENTIAL DIAGNOSTIC FEATURES

Morphological Feature	Microfilarial Species	
	D. immitis	*D. reconditum*
1. average width (μ)*	6.8 (6.1-7.2)	5.2 (4.7-5.8)
2. average length	314 (286-340)	270 (258-292)
3. anterior extremity	tapered	parallel sides
4. tail	straight	"button hooked"
5. number in sample	many	few
6. straightness	straight	crescent

*Measurement at 50-60 microns from anterior extremity.

In summary, measurement is still one of the most reliable methods of differentiation of microfilariae. The most important measurement criteria to use are the length and width (Fig. 2). Although measurement is reliable, it must be used in conjunction with other characteristics such as motility, numbers present, and morphological features of the anterior and posterior ends of the microfilariae.

It has been estimated that from 10-24% of dogs infected with *Dirofilaria immitis* show no circulating microfilariae. Several reasons may possibly be the cause for the inability to demonstrate microfilariae in the blood stream. Some of those are listed as follows:

1) Some dogs produce antibodies which trap and/or destroy microfilariae as they are shed.

2) The adults present in host animals may be only of one sex.

3) The adults in the host animal may be immature and sterile.

4) Sample size may be inadequate.

5) A microfilaricide may have recently been used.

6) Physiological aging of the parasite may have caused sterility.

Other diagnostic procedures have to be used to determine the infected status of microfilariae-free dogs suspected of heartworm disease. Radiography and angiography are valuable diagnostic aids used in diagnosing pulmonary vasculature and cardiac changes in heartworm disease. Other laboratory tests and methods of cardiac evaluation are also valuable aids in diagnosing these dogs.

Treatment

Treatment of *Dirofilaria immitis* involves different drugs in elimination of the adult parasite and the microfilariae. Thiacetarsamide sodium given intravenously is still the only recognized adulticidal agent for use while dithiazanine iodide given orally is used for eliminating microfilariae. Diethylcarbamazine given orally on a daily basis during the mosquito season and for one to two months after is the only preventive drug currently recognized for use in the dog. Diethylcarbamazine should be given only to heartworm-free dogs. Extreme care should be exercised during and following the administration of thiacetarsamide sodium.

Treatment failures using thiacetarsamide may result due to improper dosage or inability of the animal with a compromised state of health to tolerate the drug. The drug is only effective against the adult worms; hence if many are still in the fourth larval stage and immature adult stages, the percentage of kill will be reduced.

It takes approximately 5-7 months for the worm to mature and shed microfilariae after being deposited at the bite site by the mosquito. This important point must be considered in outlining a treatment schedule or blood examination schedule when the dog is not constantly exposed to heavy mosquito populations.

Other drugs such as l-tetramisole are being investigated currently which show promise in both the elimination of the adult parasite and the microfilariae.

Self-assessment questions

1. The concentration methods of blood examination for microfilariae are stated to have what percent detection rate?
   a) 75-80%
   b) 65-75%
   c) 85-90%
   d) 95% or above

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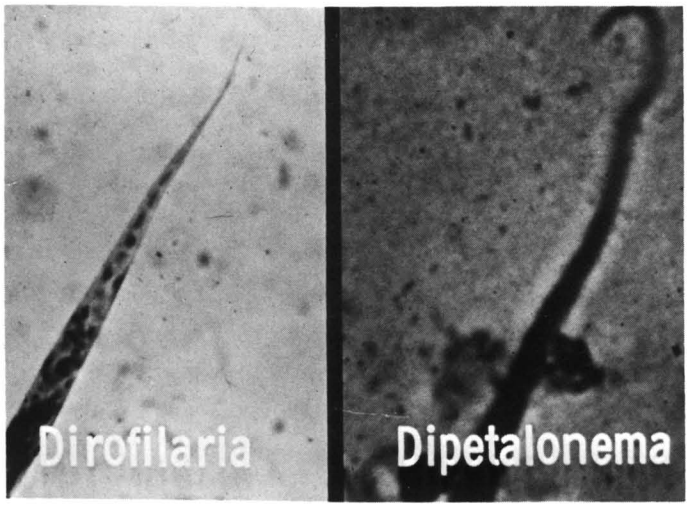

Photo courtesy of Dr. Robert Corwin

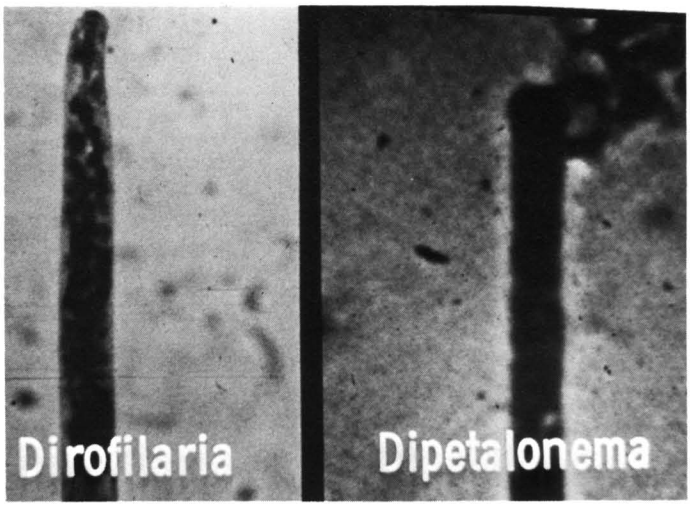

Photo courtesy of Dr. Robert Corwin

Heartworms con't

2. The only drug currently recommended for use as a *Dirofilaria* adulticidal agent is
   a) thiacetarsamide
   b) diethylcarbamazine
   c) l-tetramisole
   d) piperazine

3. It takes about how many months after exposure to infective larval stage for the worm to mature and shed microfilariae into the blood stream?
   a) 3-4 months
   b) 2-3 months
   c) 7-8 months
   d) 5-7 months

4. Diethylcarbamazine should be given only
   a) as a treatment for adult roundworms
   b) to treat worm-free dogs
   c) as a microfilariacidal agent
   d) none of the above

5. Biological vectors for *Dirofilaria immitis* in Missouri are
   a) eye gnats
   b) biting lice and fleas
   c) mosquitoes
   d) all of the above

Answers: c, a, d, b, c

Atrophic rhinitis still causes problems

Atrophic rhinitis continues to be a rather prevalent problem as young pigs are highly susceptible to the bacterium *Bordetella bronchiseptica*. The agent lives for a rather short period of time outside the host but it has a wide range of carriers. Most mammals and even birds may carry *Bordetella* in the respiratory tract. The virulence of this organism is variable and passage through pigs may enhance its virulence.

It has been estimated that 50% of swine herds in the U.S. are infected to some degree with *Bordetella bronchiseptica*. The prevalence of the disease makes control difficult. Atrophic rhinitis is also difficult to detect in the living animal. These factors favor spread and infection of swine.

A vaccine is being field tested that could be available soon. Research indicates that this vaccine offers 85% protection.

Other control measures are:

1) Maintain a closed herd and keep human and animal visitors to a minimum. Replacement boars should be isolated for one month and closely observed.

2) Maintain an old sow herd as much as possible. Most animals become culture negative for *Bordetella* with age.

3) Segregate animals into similar age groups. Avoid moving weaning pigs into nursery with older pigs which may be carriers. Practice "all in-all out" nursery system.

4) Culture the nasal cavity of breeding swine for *Bordetella* if the animals are valuable and facilities are available.

5) Practice good sanitation, adequate ventilation and keep stress of other diseases to a minimum.

6) Use sulfonamide treatment — sulfamethazine or sodium sulfathiazole.

Mosquitoes also transmit encephalitis

The mosquito-borne equine encephalitides are seasonal in nature as they are dependent upon the mosquito for their transmission.

In Missouri this means that infections and clinical cases (western encephalitis virus) develop in the latter part of the mosquito season. As it takes some time for a buildup of virus in the wild bird populations and other reservoirs due to complex interactions of temperature and rainfall, the early summer season is not involved.

Cases begin to appear in midsummer, peak in August and September and disappear shortly after the first mosquito-killing frost. Human cases develop later in the season, likely due to later and lesser degrees of exposure to mosquitoes. The disease is not transmitted between horses and humans, even by mosquitoes. It is rather a "common source" infection (this fact does not apply to Venezuelan encephalitis).

Western encephalitis is the only form prevalent in Missouri horses. St. Louis

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Parasitism can influence animal nutrition

The diagnosis of deficiency disease in animals receiving diets which meet or exceed recognized requirements necessitates trying to determine the cause of an apparent malabsorption. This review presents evidence that endoparasitism influences the ability to use certain nutrients. A well known example is the occasional occurrence of rickets in poultry when dietary levels of Ca and P were adequate, and several times the dietary requirements of vitamin D were provided.

Intestinal parasites damage the mucosa, in addition to secondary enteritis produced by fungi and bacteria which further reduces the absorptive area. Parasites may also influence deficiencies by absorbing the host's food, withdrawing its blood, causing mechanical obstruction or secreting antienzymes, anticoagulants or other toxic substances.

Swine ascarids interfere with nutrition as measured by weight gain and feed conversion in a direct relationship to the number of worms harbored. In sheep with mild *Trichostrongylus* infection or *Trichostrongylus* plus *Strongyloides* there is interference with the conversion of carotene to vitamin A. *Trichostrongylus* also cause retention of sodium in lambs. Affected lambs maintain relatively high Na levels, while excretion of K, Ca, P and protein-nitrogen nears or often exceeds intake. This may explain why animals on marginal diets seem more severely affected by parasitism than those adequately fed.

Ostertagia larva may remain in the gastric glands of cattle for several months. This condition is known as histotropic or type 2 ostertagiasis. Parietal cells lose their ability to produce acid. Thus the pH of the abomasum becomes more alkaline. Once the pH climbs above 4.5 the pepsinogen is no longer activated and the animal loses its pepsin digestive abilities.

Canine *Toxocara* is reported to reduce N-retention (protein utilization) when diets contain poor quality protein. Impaired N-retention is not due to decreased digestibility, but by increased catabolism probably due to a parasite toxin or the associated microorganisms. The effect on the developing puppy is commonplace.

Parasites in sheep and cattle are known to depress appetite and digestibility to average about 10% less feed absorbed in infected than control calves. These studies also show either a greater blood loss or lesser capabilities to regenerate lost blood in both these species when feed intake is low.

The amount of feed consumed by sheep and cattle does not appreciably affect susceptibility to parasitic infections except in the instance of *Cooperia spp.* In an experiment to evaluate the effect of high and low level feeding upon infection rates, in 250-300 lb. calves, 7.73 times as many *Cooperia oncophora* were recovered in animals on low level feeding. The level of feeding had little effect on the number of worms reaching maturity, but lesions were more severe in calves on the low feeding level.

The gain in feed conversion efficiency of infected calves was adversely affected regardless of whether they were on high level (to gain 1.4 lb/day) or low levels (to gain 0.35 lb/day) of feeding. No evidence was found to support the concept of many cattlemen that animals placed on fattening diets expel worms.

(Source: Dr. R.F. Miller. *Feedstuffs,* 39 (1967):15-20.)

Encephalitis con't

encephalitis clinically affects only the human; even subclinical infections in horses are rare.

Last year's intense activity of St. Louis encephalitis in humans of the Midwest is, however, an ecological reminder that the conditions are ready and we could have more western encephalitis in horses this year. While in 1973 and 1974 there were no confirmed cases of western encephalitis in horses reported to the Missouri Division of Health, there were 18 in 1975 (these confirmed by a rise in titer observed in paired serum samples). Many of the rumors of epidemics in horses last year were unfounded. However, there were undoubtedly many unreported cases.

The seasonal cyclicity of the disease is well known; less well known is a trend to peaks and valleys in infection levels every few years. While weather extremes could alter the point, we could well see more western encephalitis in Missouri this year.

It is time to be programming your spring calendar to include immunization of horses against the viral encephalitides.

Self-assessment questions

1. Malabsorption caused by parasitism may be due to
   a) loss of absorptive area from mucosal damage and enteritis
   b) excess vitamin D in the diet
   c) increased N-retention from catabolism
   d) increased sensitivity to infection on high level feeding

2. The only instance of increased susceptibility to infection as an affect of low level feeding was with the species
   a) *Toxocara*
   b) *Trichostrongylus*
   c) *Strongyloides*
   d) *Cooperia*

3. *Trichostrongylus* and *Strongyloides* infection are known to
   a) cause K-retention and excessive excretion of Ca, P, Na and protein nitrogen
   b) interfere with carotene conversion in lambs
   c) cause mechanical obstruction in lambs
   d) be enhanced by high level feeding

4. *Toxocara* infection reduces N-retention in dogs on poor quality diets by
   a) decreasing digestibility of protein
   b) increased protein catabolism
   c) 7.73 times normal
   d) 10%

5. Parasitized sheep and cattle are known to
   a) consume more but absorb less feed
   b) be commonly deficient in vitamin A
   c) absorb about 10% less than normal from appetite depression and reduced digestibility
   d) have increased feed conversion efficiency even though they consume less

Answers: a, d, b, b, c

Around the College. . .

Faculty attend MVMA meeting

The College of Veterinary Medicine was well represented when the Missouri Veterinary Medical Association held their 84th Annual Convention Jan. 25-27 at Lake Ozark.

Attending from the College were: Drs. A.A. Case, J.T. McGinity, K.H. Niemeyer, Dept. of Veterinary Medicine and Surgery; W.H. Eyestone, L.G. Morehouse, Veterinary Pathology; R.W. Loan, E.L. McCune, Veterinary Microbiology; D.C. Blenden, B.L. Moseley, J.D. Rhoades, Continuing Education in Veterinary Medicine; and Dean K.D. Weide.

Officers installed at the Convention were Dr. E.E. Burgess, Jefferson City, President; W.F. Bryson, Fredericktown, President-Elect; C.E. Martin, College of Veterinary Medicine, Vice President; and B.L. Moseley, College of Veterinary Medicine, Secretary-Treasurer.

The Class of 1956 held their 20-year reunion in conjunction with the meeting. Nine members of the original class of 28 attended, one from as far away as Florida and another from Arizona.

Precommencement set

Precommencement Exercises for the 27th Graduating Class of the College of Veterinary Medicine have been set for Saturday, May 8, 1976, 10:00 a.m. in the Hearnes Multipurpose Bldg.

Dr. James Boillot, Director of the Missouri Department of Agriculture, will give the address.

Immediately following the ceremonies there will be a reception for the graduates, their family and friends, faculty and guests.

College hires epidemiologist

Dr. David Gordon Thawley has been appointed assistant professor in veterinary microbiology. He joins the College from the Department of Clinical Sciences, Massey University, New Zealand.

Dr. Thawley's area of specialization is epidemiology of zoonoses. He earned a B.V.Sc. degree from Massey University and a Ph.D. from the University of Guelph. Dr. Thawley's teaching responsibilities will be in the veterinary public health block and his research efforts will primarily be in zoonoses and infectious disease. He replaces Dr. C. Richard Dorn who resigned last July.

Career Day set on March 25

Career Day for high school students will be held March 25 at the College of Veterinary Medicine for the 13th year. The Missouri Veterinary Medical Association sponsors Career Day in cooperation with the faculty of the College and the student chapter of the AVMA.

Career Day includes tours of the College and educational displays in anatomy, microbiology, pathology and physiology, as well as viewing of radiographs, clinical pathology examinations and surgical procedures at the Veterinary Teaching Hospital.

Dr. David G. Thawley

Dr. James E. Breazile

Dr. Breazile elected

Dr. James E. Breazile, professor of veterinary anatomy-physiology, was recently elected president of the Executive Board of the Conference of Research Workers in Animal Diseases. He has served on the Board four years previously.

The Conference of Research Workers in Animal Diseases is a 577-member organization whose purpose is to promote research in veterinary medicine. The group meets annually in Chicago.

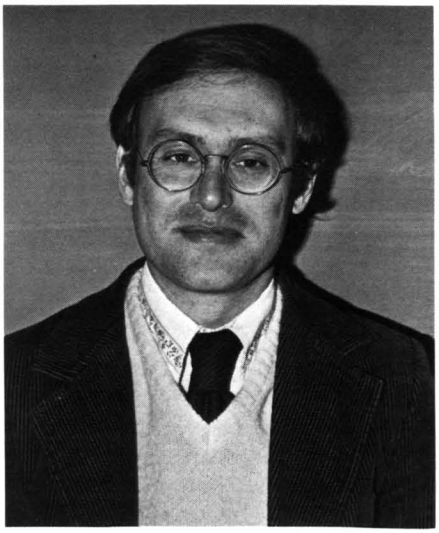
The Conference is a rather unique organization in that its members present research that is in progress, not already published. In this way their colleagues may have input into ongoing research and may make any appropriate suggestions about how the research might be redirected.

Gifts accepted for Clark Fund

Donations are still being accepted for the Doctor William D. Clark Memorial Fund, c/o College of Veterinary Medicine, University of Missouri, Columbia, MO 65201.

This memorial fund was established by Dr. Clark's family after his death in November and will probably be used for items needed when the new buildings at the College are completed.

Dean Weide reports that he and Dr. Clark's family will be making a decision soon on what to purchase.



Dr. Harkness promoted

Dr. John Harkness, research associate in veterinary pathology, has been promoted to assistant professor and laboratory animal veterinarian in medicine and surgery.

Dr. Harkness' new responsibilities will be to care for the research animal colonies on the Columbia campus (except the Medical Center) and teach in the laboratory animal medicine block.

Dr. Harkness earned a B.S. from Rollins College in Florida and a D.V.M. from Michigan State University. He has been with the College since February, 1973.

Student completes block in Scotland

Peggy Miller, VM3, has returned to the College after completing a November-December off block in Scotland. Peggy worked mainly around Crief, a town of about 6,000 located in the heart of Scotland.

She worked with three veterinarians in a large animal practice doing ambulatory work extensively. Peggy saw mostly dairy cattle although she reported there were more sheep in Scotland than anything else and that the people there consume a great deal of mutton.

Monensin found toxic

Preliminary reports, *Vet. Rec.* 97 (1975): 137-138, indicate that monensin sodium, used as a coccidiostat and now approved as a cattle feed additive may be toxic to horses at levels of 100 ppm.

Care should be taken to advise clients to prevent access of horses to feed containing monensin.

During sabbatical leave

Dr. Blenden advances rabies diagnostic method

Dr. Donald C. Blenden, Director of Continuing Education in Veterinary Medicine and professor of veterinary microbiology, has completed a one year's sabbatical leave from the University of Missouri-Columbia.

During his leave period, Dr. Blenden advanced the use of skin biopsy for the diagnosis of rabies in animals and man. In the past the only reliable diagnostic technique has been examination of brain tissue. Through research efforts supported by American Kennel Club, Pan American Health Organization, World Health Organization, several private donors and the University of Missouri, Dr. Blenden has developed a technique whereby an animal or person can be reliably examined for rabies with a small skin biopsy taken from the head region.

In human cases early diagnosis is the only way to advance new methods for treatment. In bite cases where it is undesirable to put the biting animal to death it can be examined for rabies and a specific diagnosis made in a matter of hours without the use of brain. The animal then can be observed for further clinical signs or ultimate discharge.

When Dr. Blenden began his research, he had in mind the application of his technique primarily in dogs. However, he found it applicable to mice, foxes, skunks, raccoons, cattle, cats, horses, mongooses, bats and man in addition to dogs.

His laboratory at the Veterinary Medicine Research Farm north of Columbia now receives human specimens for diagnosis from all over the United States. In fact the last three cases of human rabies which occurred in this country were diagnosed prior to death in Dr. Blenden's laboratory. This breakthrough in the diagnosis of human rabies gives physicians a specific diagnosis of what to treat for before their patient is hopelessly advanced.

Another unexpected result of Dr. Blenden's work is evidence indicating some species, notably swine, are greatly resistant to infection with rabies virus. These results are a direct indicator that the disease need not be fatal and may lead the way to new ideas for treatment and recovery from the disease.

Also indicated by Dr. Blenden's research is the possibility that the use of skin as a biopsy tissue may be applicable to other diseases. He has preliminary results indicating the same basic technique can be used in other virus infections of the brain. Included in these are herpes and mosquito borne encephalitides of man and animals, and distemper of dogs.

Dr. Leroy Atkinson (right) visited with Dean K.D. Weide while at the College recently to give a presentation at a meeting of the Student Chapter of the AVMA. Dr. Atkinson of County Animal Hospital, St. Louis, is a member of the College Development Fund Committee and a strong supporter of the College.

Faculty Notes

Dr. W.H. Eyestone, professor and chairman of veterinary pathology, attended a meeting of the National Advisory Council on Health Professions Education in Bethesda, MD on Jan. 5-7.

Dr. L.D. Olson, associate professor of veterinary pathology, attended the Annual Meeting of Missouri Pork Producers Association in St. Joseph on Jan. 9 and 10. He spoke on "TGE, Bloody Scours and Pseudorabies — Major Swine Health Problems."

Dr. C.J. Bierschwal, professor of veterinary medicine and surgery, presented six papers at the International Stockman's School in San Antonio, TX on Jan. 10-16; First Aid for Calving, Care of Newborn, Herd Reproductive Health Programs, Anestrus in the Dairy Cow, Cystic Ovary in the Dairy Cow, Retained Placenta and Infection in the Reproductive Tract.

Dr. C.W. Foley, professor of veterinary anatomy-physiology, presented "AI in Swine" to North Carolina Swine Producers in Raleigh, NC on Jan. 13.

Dr. C.E. Short, professor of veterinary medicine and surgery, presented the course "Current Aspects of Anesthesia" for the South Carolina Veterinary Medical Assoc. in Columbia, SC on Jan. 17-20.

Dr. R.S. Youngquist, associate professor of veterinary medicine and surgery, attended the Forty-fifth Annual Conference for Veterinarians at Louisiana State University, Baton Rouge, Jan 18-22 and presented "The Normal Bovine Estrous Cycle," "Abnormal Bovine Estrous Cycle," and "Reproductive Record System."

Dr. L.D. Kintner, professor of veterinary pathology, attended a course on foreign animal diseases at Plum Island, NY on Jan. 18-23.

Dr. K.H. Niemeyer, professor of veterinary medicine and surgery, and *Dr. C.E. Martin,* professor and chairman of veterinary medicine and surgery, attended the annual meeting of Chairmen of Clinical Departments which was sponsored by the American Association of Veterinary Clinicians in Chicago on Feb. 19.

Dr. C.J. Bierschwal, professor of veterinary medicine and surgery, presented "The Technique of Fetotomy in Large Animals" and "Cystic Ovary in the Dairy Cow — Treatment with GnRH" at the 68th Annual Conference for Veterinarians in Ithaca, NY on Jan. 20-22.

Dr. H.K. Adldinger, associate professor of veterinary microbiology, presented a seminar on "Cell-mediated Immunity in Marek's Disease" at the USDA Regional Poultry Laboratory in East Lansing, MI on Jan. 20-22.

Dr. M.J. Bojrab, associate professor of veterinary medicine and surgery, presented a three-hour seminar on surgery of the head and neck region to the Indiana Veterinary Medical Assoc. in Indianapolis on Jan. 25.

Dr. C.J. Bierschwal, professor of veterinary medicine and surgery, presented "Physiology of Reproduction in the Bovine" at the Indiana State Veterinary Medical Assoc. meeting in Indianapolis on Jan. 26-27. He also presented "Reproductive Failure in the Bovine, Equine and Swine" in conjunction with *Dr. C.E. Martin,* professor and chairman of veterinary medicine and surgery.

Dr. D.C. Blenden, professor of veterinary microbiology and director of continuing education in veterinary medicine, presented "Advances and Problems in the Laboratory Diagnosis of Rabies" at the Northwest Rabies Symposium for Veterinarians and Physicians in Portland, OR on Feb. 10-12.

Dr. M.E. Tumbleson, associate professor of veterinary anatomy-physiology, presented the lecture "Miniature Swine as a Model for Study of Human Alcoholism" at the Eighth Annual Food and Nutrition Seminar in Springfield, MO on Feb. 10.

Dr. M.J. Bojrab, associate professor of veterinary medicine and surgery, presented a six-hour seminar on soft tissue surgery to the Los Angeles Small Animal Assoc. on Feb. 15.

Dr. J.R. Coffman, associate professor of veterinary medicine and surgery, presented a seminar on equine internal medicine in Columbus, OH on Feb. 23.

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