

RESEARCH ACCOMPLISHMENTS, ANIMAL PARASITOLOGY INSTITUTE

- 1930 - Provided identifications of external and internal parasites to investigators from federal, State, and private institutions, especially those engaged in control, eradication, or quarantine efforts. This has been a continuing service to the present day.
- Published descriptions and diagnostic keys to many parasites of livestock, poultry, wildlife, and man. This has been a continuing contribution to the present day.
- 1932 - Discovered the anthelmintic efficacy of n-butyl chloride against ascarids, hookworms, and whipworms in dogs.
- 1933 - Described morphological features of the infective stages of 11 species of worm parasites of sheep, providing an important tool for research and diagnostic laboratories.
- Showed that Dermacentor andersoni, the Rocky Mountain wood tick, was an efficient vector of anaplasmosis.
- Determined the life history of Strongyloides ransomi, an intestinal worm parasite of swine, and developed information for use in formulating control measures.
- 1934 - Discovered the therapeutic value of stibophen for controlling heartworms in dogs, a particularly disabling disease of this companion animal of man.
- 1936 - U.S. National Museum Helminthological Collection and the Bureau of Animal Industry Parasite Collection were combined to establish one of the largest collections of animal parasites in the world.
- This working tool, designated the National Parasite Collection in 1969, has provided reference specimens for countless workers around the world and is indispensable in USDA quarantine and eradication efforts.
- 1937 - Showed that helminth infections are acquired by suckling pigs during their first 3 weeks of life.
- Demonstrated the feasibility of preserving the etiologic agent of anaplasmosis, Anaplasma marginale, by storage at dry-ice temperatures, -78.6°C .

- 1938 - Discovered the broad spectrum anthelmintic action of phenothiazine against worm parasites of livestock and poultry.
- Determined that infective stages of swine lungworms survive in earthworms for at least 4 years.
- 1939 - Prepared photographs and comprehensive descriptions of the eggs of ruminant helminth parasites, providing an important diagnostic tool for researchers and diagnosticians.
- Discovered the anthelmintic efficiency of barium antimonyl tartrate against the gapeworm, Syngamus trachea, in poultry.
 - Showed that phenothiazine was effective in removing the cecal worm, Heterakis gallinarum, carrier of the causative agent of blackhead in poultry.
- 1940 - Elucidated the life history of Macracanthorhynchus hirudinaceus, the thorn-headed worm of swine.
- 1941 - Discovered the usefulness of sulfa drugs for the control of coccidiosis in domestic animals and poultry.
- Proved that anaplasmosis was transmitted directly between cattle by the horse-fly, Tabanus sulcifrons.
 - Published the first report of myocardial involvement in sudden death of pigs from Strongyloides ransomi infections.
- 1942 - Compiled information for the Armed Services during World War II on the distribution and vectors of such tropical parasitic diseases as malaria, filariasis, and schistosomiasis, in strategic areas.
- Discovered, developed, and standardized the use of free-choice, low level, phenothiazine-mineral mixtures for reducing pasture contamination with infective stages of gastrointestinal nematode parasites affecting sheep, cattle, horses, and other livestock.
 - Showed that Anaplasma marginale develops in red blood cells by progressive multiplication, with the marginal body containing up to eight smaller units.

- 1942 - Elucidated pathogenicity of the thorn-headed worm of swine, Macracanthorhynchus hirudinaceus, from studies of experimental infections; determined that eggs of this parasite may remain viable in soil for more than 3 years at Beltsville.
- 1943 - Showed that repeated small doses of the cecal coccidium, Eimeria tenella, produced immunity to subsequent exposure for at least 6 months.
- 1945 - Published and later revised (1964) a Check List of Internal and External Parasites of Domestic Animals in the United States, its Possessions, and Canada, including data on distribution. This is one of the most widely used and cited references in veterinary parasitology.
- Developed and standardized the sodium fluoride treatment for removal of large roundworms from swine.
- 1946 - Showed that eggs from cecal worms removed by anthelmintics could still hatch and release the protozoan parasite, Histomonas meleagridis, causing blackhead disease in poultry.
- 1947 - Developed an effective method for destroying infective stages of the "beef tapeworm" of man by refrigeration. This enabled many carcasses to be saved that previously had been condemned as unfit for human food.
- Showed that artificial insemination was a means of transmitting bovine venereal trichomoniasis.
- 1948 - Demonstrated the economic effects of parasitic infections in pigs.
- Showed that a combination of trypanflavin and sulfur was an effective local treatment for bulls infected with Tritrichomonas foetus.
- 1949 - Showed that certain species of coccidial oocysts from poultry survived on soil for as long as 86 weeks.
- 1950 - Reported the transmission of Trichinella spiralis infection in swine through ingestion of swine feces.
- 1951 - Clarified confused taxonomy of nematodes of horses by publishing a list of valid names after appeal to International Commission on Zoological Nomenclature.

- 1951 - Compiled information requested by the U.S. Armed Forces on dog parasites in the Far East during the Korean conflict. These parasites, particularly the heartworm, were serious problems among sentry dogs.
- Developed an improved technique for the recovery of encapsulated, infective larvae of Trichinella spiralis.
- 1952 - Completed publication of the Author Catalogue of the world-famous 18-part Index-Catalogue of Medical and Veterinary Zoology, a bibliography of all known literature on parasitology. Supplements of the Author Catalogue have been published on a continuing basis at about 2-year intervals.
- Developed the complement-fixation test as a practical and standard laboratory method for the diagnosis of both acute and carrier cases of anaplasmosis. (In cooperation with researchers at State Experiment Stations in Oklahoma, Louisiana, and Maryland.)
- 1953 - Demonstrated the synergistic lethal effect of dual- and triple-species helminthic infections in sheep.
- Elucidated the life cycle of the sheep coccidium, Eimeria arloingi. This is representative of similar work with other species of coccidia in sheep.
- 1955 - Reported that eggs of Trichuris suis, the whipworm of swine, survive on pasture at Beltsville for at least 6 years.
- Showed that nasal trichomonads from swine were capable of causing abortion in cattle.
- 1956 - Elucidated the life cycle of the medium stomach worm, Ostertagia ostertagi, the most important nematode pathogen of cattle in the United States. This is representative of similar work with other helminths of livestock and poultry.
- Proved that nasal trichomonads of swine had no causal relationship to atrophic rhinitis in this host.
 - Found that eggs of the cecal worm, Heterakis gallinarum, remained infective to chicks and turkeys after 66 weeks in and on soil.
- 1957 - Developed differential diagnostic keys for the identification of all immature stages of eight of the most common gastrointestinal worm parasites of cattle.

- 1957 - Showed that Trichostrongylus and Ostertagia, nematode parasites of cattle, were transmissible to swine.
- Devised a culture medium for growing Tritrichomonas foetus that permitted more accurate diagnosis of bovine venereal trichomoniasis.
- 1958 - Proved that the red stomach worm of swine, Hyostrongylus rubidus, was easily transmitted to calves in which it produced a disease similar to that seen in the porcine host.
- 1959 - Defined the importance of good nutrition as an essential factor in protecting livestock against the effects of parasitic diseases.
- 1960 - Described the development of bovine cysticercosis which provides invaluable information for determining the age, and hence probable source, of infection in beef carcasses; this information is necessary in implementing control and eradication programs, and in establishing appropriate procedures in connection with federal meat inspection regulations.
- Provided prompt identification of the African red tick, Rhipicephalus evertsi, an exotic species which was found in the U.S. for the first time in 1960. This enabled the eradication of this parasite, a known vector of several important diseases of livestock, within a relatively short period.
 - Developed methods for growing worm parasites of livestock in artificial culture systems, a significant contribution to studies of physiological and immunological aspects of parasitism.
 - Showed that ineffective control of gastrointestinal parasitism in sheep at Beltsville, despite frequent medication with the best available anthelmintic, was ascribable to infection with a phenothiazine resistant strain of Haemonchus contortus, the major parasitic pathogen in the flock.
 - Discovered the teniacidal action of bithionol against tapeworm infections in dogs, cats, and sheep.
 - Developed a mechanical apparatus to facilitate the separation of Ascaris and Trichuris eggs from swine feces.
- 1961 - Provided the first identification of the rat lungworm, Angiostrongylus cantonensis, from the brain of a man. This led to the discovery that the nematode is the causative agent of parasitic or eosinophilic meningoencephalitis.

- 1961 - Showed that Eimeria tenella, the coccidium causing cecal coccidiosis in chickens, can become drug resistant.
- Proved that the earthworm is a vector of blackhead disease, a fatal parasitic infection of poultry.
- 1962 - Discovered the therapeutic value of bithionol against the liver tapeworm (Thysanosoma actinioides) of sheep. (In cooperation with ARS parasitologists at Las Cruces, New Mexico.)
- Developed a simple, reliable in vitro method for obtaining large numbers of excysted coccidial sporozoites.
- 1963 - Established that male Rocky Mountain wood ticks were capable of harboring the causative agent of bovine anaplasmosis through the winter months, thus providing a mechanism for re-infection of cattle.
- Characterized the antigens and antibodies involved in serological tests for the diagnosis of kidney worm infections in swine.
 - Showed that dimetridazole, a synthetic compound, was effective as a systemic treatment against bovine venereal trichomoniasis.
- 1964 - Identified and described a new nematode parasite of man, Capillaria philippinensis, that in a few years caused more than 200 deaths in the Philippine Islands. The accurate morphological observations and descriptions provided valuable clues to the life cycle of the parasite.
- Identified the tropical horse tick, Dermacentor nitens, as the intermediate host for the transmission of equine piroplasmosis in the United States.
 - Established that cells of the excretory gland in the swine kidney worm, Stephanurus dentatus, were the principal source of antigen production.
 - Showed that intestinal coccidia of sheep develop in locations outside the intestinal tract of goats, but do not complete their life cycle.
- 1965 - Showed that partial immunization of calves against the lungworm, Dictyocaulus viviparus, was accomplished by oral vaccination with the less pathogenic related species, D. filaria, of sheep.

- 1966 - Showed that oral vaccination of cattle with x-ray attenuated eggs of the "beef tapeworm" effectively immunized cattle against beef measles.
- Demonstrated the first successful use of mammalian tissue cultures for in vitro cultivation of a parasitic nematode.
 - Showed that precooling trichinous pork increased the resistance of trichinae to destruction at freezing temperatures.
- 1967 - Discovered the therapeutic value of niclosamide against the fringed tapeworm, Thysanosoma actinioides, of sheep. (In cooperation with ARS parasitologists at Las Cruces, New Mexico.)
- Showed that animals with equine piroplasmiasis remained "carriers" of the disease organisms, and consequently sources of reinfection, for at least two years after all symptoms of the disease disappeared.
 - Elucidated the complete life cycle of the poultry coccidium, Eimeria acervulina.
- 1968 - Elucidated the complex interrelationships between the environment and the epidemiology of helminthic diseases in cattle.
- Devised a rapid card agglutination test for the serologic diagnosis of bovine anaplasmosis. This simple test can be conducted on the farm or ranch, as well as in the laboratory. It was recognized as an official test by federal and state regulatory officials in 1973.
 - Showed that ticks harboring Babesia caballi, a causative agent of equine piroplasmiasis, were free of the parasites after living for two generations on cattle. This indicates the possibility of non-chemical control of the disease by pasturing cattle on affected areas in sufficient numbers and for an adequate period for the ticks to develop through two generations on cattle.
 - Found that excysted coccidial sporozoites could be frozen and stored at -170 degrees centigrade for an indefinite period without losing their viability.
- 1969 - At the request of the U.S. Armed Services, published a special bibliography and lists of parasites of man and domestic animals in Vietnam during the conflict in Southeast Asia.
- Demonstrated the first occurrence in Maryland of resistance to the widely used drug, thiabendazole, in a strain of the large stomach worm of sheep, Haemonchus contortus.

- 1969 - Showed for the first time that the new anthelmintic, tetramisole, was highly effective against the large roundworm, Ascaridia dissimilis, the cecal worm, Heterakis gallinarum, and the intestinal threadworm, Capillaria obsignata, in turkeys. This was the first effective anthelmintic against the intestinal threadworm.
- Developed serologic diagnostic tests for the detection and differentiation of Babesia caballi and B. equi infections in horses.
 - Provided protocols to diagnostic laboratories around the world for the production of CF antigen for use in diagnostic tests to detect equine piroplasmiasis.
 - Completed definitive redescrptions of the life cycle and morphogenesis of Ascaris suum, one of the most important worm parasites of swine.
 - Showed that the pooled sample digestion technique for diagnosis of trichiniasis in swine carcasses was very sensitive and easily adaptable to the high-speed operation of a modern abattoir. (In cooperation with workers in the Animal and Plant Health Inspection Service, USDA.)
 - Devised a method utilizing continuous-flow differential density flotation for recovering from chicken droppings large numbers of coccidial oocysts with a high percentage sporulation.
- 1970 - Published a checklist of the internal and external parasites of deer in North America.
- Showed that the nodular worm, Oesophagostomum columbianum, normally parasitic in sheep, produced intestinal lesions in calves and thus contraindicates management practices recommending mixed or alternate grazing of pastures by cattle and sheep to control gastrointestinal parasitism.
 - Determined the life cycle of Babesia caballi in its vector, the tropical horse tick.
 - Cultivated Ascaris suum, the large roundworm of swine, to the fourth larval stage *in vitro*.
 - Cultivated Eimeria tenella, the protozoan parasite causing cecal coccidiosis in chickens, through its entire life cycle in cell culture. This was a major advance toward the development of a protective vaccine against this highly pathogenic poultry disease.

- 1971 - Discovered larvae of the eyeworm, Thelazia gulosa, in the face fly, Musca autumnalis. This was the first report of a natural vector for the eyeworm of cattle in eastern North America.
- Demonstrated for the first time that sheep strains of the common stomach worm (Haemonchus contortus) resistant to widely used benzimidazole anthelmintics (e.g. thiabendazole) were susceptible to non-benzimidazole compounds, such as levamisole.
 - In cooperation with several Western States, determined that Anaplasma marginale was prevalent as a latent infection in black-tailed deer inhabiting the coastal range of California, that the Pacific coast tick was an efficient vector of anaplasmosis, and that bison, antelope, and mule deer in the Rocky Mountain States were relatively free from bovine anaplasmosis. These are important elements in understanding the epidemiology of this disease.
 - Showed that Babesia caballi, the causative agent of equine piroplasmosis, multiplies in the tick vector and that the tick, therefore, is not merely a passive transmitter of the disease agent.
 - Characterized cuticular lesions of Ascaris suum histologically and identified certain associated microorganisms.
 - Established criteria for evaluating the development of Ascaris suum in laboratory animals commonly used as experimental hosts.
- 1972 - Described the morphogenesis of larval stages of Stephanurus dentatus, the swine kidney worm. This new information on the life cycle will be useful in research efforts directed toward the development of a protective vaccine against the nematode.
- Published the first manual for the identification of parasites in tissue sections, including 249 figures of parasites in lesions.
 - Discovered that the experimental drug imidocarb was highly effective for the elimination of Babesia caballi infections in horses.
 - Produced for the first time experimentally a cambendazole resistant strain of the highly pathogenic stomach worm parasite, Haemonchus contortus, of sheep. This demonstrated the marked potential for rapid emergency of drug resistant worm parasites in livestock.

- 1972 - Adapted the hemoglobin-free anaplasmosis card test antigen to the microtiter complement-fixation test. This antigen, which is currently used in many diagnostic laboratories, affords considerable economy of reagents and results in significantly improved accuracy.
- Showed that the soluble antigen fluorescent antibody test was capable of identifying 92% of garbage-fed hogs naturally infected with Trichinella spiralis.
 - Cultivated in cell culture the muscle parasite, Sarcocystis, which occurs in birds, humans, livestock and other animals and proved for the first time that it was a coccidium.
 - Showed that day-old lambs were susceptible to coccidial infections.
 - Elucidated the ultrastructure of Eimeria tenella from sporozoites to first generation merozoites.
- 1973 - Issued a detailed, indexed catalogue of the literature on Chagas disease, an important disease of humans in South America.
- Demonstrated the potential for immunizing cattle against gastrointestinal helminth parasites by vaccination with larval stages grown in vitro.
 - Determined that imidocarb, an experimental drug, can eliminate Anaplasma marginale infections in adult carrier cattle.
- 1974 - Published a monumental index to the literature on ticks and tick-borne diseases of man and animals.
- Determined that adult cattle were resistant to re-infection with Anaplasma marginale after the carrier state had been eliminated by treatment with imidocarb.
 - Elucidated the life cycle and pathogenic effects produced by the muscle parasite, Sarcocystis fusiformis, in domesticated animals.