

Conceptual Firsts Accomplished in Helminthological Investigations

1887 - Results of studies on flukes in the liver and lungs of cattle, pointing out their causative relationship to lesions in the viscera of infected animals, were published.

1889 - The disease caused by the fringed tapeworm, Thysanosoma actinioides, of sheep was first described.

1891 - Discovery that Nodular Disease of Sheep is caused by a new roundworm, Oesophagostomum columbianum. Nodular disease of sheep formerly had been thought to be a form of tuberculosis. The discovery of its nature and cause has been extremely important in determining the disposition of carcasses under meat inspection procedures.

1898 - The first publication of the Department of Agriculture dealing generally with the helminth parasites which invade the flesh and viscera of carcasses of meat-producing animals thus rendering them unfit for human food was published.

1900 - The kidney worm, Stephanurus dentatus, of swine was pointed out as an important cause of widespread damage to hog carcasses.

1902 - Discovery that a new hookworm, Uncinaria americana, was the cause of anemia of man in the South. This discovery served as the beginning of public health and Rockefeller Foundation activities on the control of this important parasite of human beings which served as a major factor in the backward development of the economy of many Southern States.

1902-1912 - Publication of the Author Section of the Index-Catalogue of Medical and Veterinary Zoology. This catalogue originally published as Bulletin No. 39 of the Bureau of Animal Industry and its subsequent revision and publication of parts 1 to 18, and supplements 1 to 10, with part 11 in press, and part 12 in preparation, constitutes the most complete

2 - First accomplished in Helm. Invest.

1902-1912 (continued): reference to the literature in the field of medical and veterinary parasitology in the world.

1905 - The first well-authenticated case of gid in sheep was reported from the United States. Five years later the coyote was shown to be the host of the adult tapeworm, Multiceps multiceps, and a Federal quarantine on imported sheep dogs was established to prevent the introduction of dangerous worms.

1906 - Elucidation of the life history of the sheep stomach worm. This work has served as the basis for subsequent investigations on the life histories of related roundworms of domestic animals and has aided in the formulation of control procedures for these parasites.

1907 - The development of adult nematodes of the genus Strongyloides following cutaneous infection was reported.

1911 - The discovery of the life history of the stomach worm, Habronema muscae, of horses enabled European and Australian scientists to solve the problem of the cause of "summer sores" of horses. It was demonstrated that these lesions were caused by the larvae of this parasite which developed in houseflies.

1914-1920 - Discovery that trichinae in pork and larval tapeworms of beef may be destroyed by refrigeration, by heating at relatively low temperatures, and by curing procedures. This and subsequent work has formed the basis for meat inspection regulations covering the processing of those meat products which are customarily eaten without cooking to insure safety from trichinae and tapeworm infections in man.

3 - Firsts accomplished in Helm. Invest.

1917 - New facts were discovered in the life history of the large roundworm of swine, Ascaris lumbricoides, including the fact that ascarid larvae may cause serious or fatal pneumonia in the course of their migration through the lungs of young pigs and the fact was established that no intermediate host was necessary for their development.

1919 - Development of the McLean County System of Swine Sanitation. This is a procedure based upon sound biological principles discovered in the Bureau of Animal Industry that permit the raising of pigs free from the destructive intestinal roundworm, Ascaris lumbricoides, and also reduces losses from filth-borne diseases. Under this system pigs reach market weight sooner than under ordinary systems of management and enable the farmer to raise as many pigs as formerly with about two-thirds as many sows. This system is widely used in the swine-raising States of the Middlewest.

1923 - The first successful experimental intrauterine infection of pups with dog ascarids was reported.

1929-1938 - Discovery of the life cycles of nematodes and cestodes of poultry. During this period the life cycles of most of the important roundworm and tapeworm parasites of poultry were elucidated, thus affording important facts upon which the control measures could be based.

1939 - The first studies in the United States were made on the relationship between nematode infections and the host's nutrition.

1942 - The intestinal threadworm of swine, Strongyloides ransomi, was first reported to cause mortality in pigs, and the first comprehensive study of the incidence of the parasites of cattle in the United States was made in the southeastern States.

4 - Firsts accomplished in Helm. Invest.

1943 - The first studies on the fumigation of soil to destroy larval stages of animal parasites were conducted.

1948 - The relationship between nematodes and skin lesions of domestic animals was described from cattle in the United States. Cases of icterus in hogs resulting in their condemnation as unfit for food were found to be caused by the large roundworm which plugged the bile duct of the liver. The fact that wild rabbits serve as reservoir hosts of the common liver fluke of ruminants was shown to be a vital factor in the control of this parasite in endemic areas.

Accomplishments of Helminthological Investigations

The following historically important developments that have grown out of the work of the Department in Helminthology are considered to be of special significance:

1887. Pointed out causal relationship of flukes to lesions in the liver and lungs of cattle. ✓

1889. First described thysanosomiasis of sheep. ✓

1890. First described the nodular worm of sheep, Oesophagostomum columbianum, and demonstrated that it was the cause of "knotty guts". In 1944, this parasite was found to cause stunting and deterioration in wool quality produced by lambs that survived moderate to heavy infections. ✓

1898. First publication of the Department dealing with helminthic parasites that invade the flesh and viscera of meat-producing animals thus rendering them unfit for human food. ✓

1900. First report on the kidney worm of swine and its importance as a cause of widespread damage to hog carcasses. Further studies in 1912 emphasized the economic importance of this parasite as a cause of widespread condemnation of hog livers, loins, kidneys and kidney fat. Because this parasite is inaccessible to available drugs and has not been controlled by previously designed prophylactic measures, biological means for its control were investigated. In 1934 the McLean County Swine Sanitation System was modified in an effort to control kidney worms in the South. This system was partially successful in controlling kidney worms, but met opposition from farmers because of the cost of putting it into operation. In 1957 an economical and practical management system for preventing the acquisition of kidney worms by swine was developed.

1901. Papers were published on hookworm disease in man and animals in the United States and on trichinosis. A second paper on trichinosis demonstrated that the microscopic inspection of pork for trichinae was not an effective means for ascertaining that a carcass was not infected with this parasite.

1902. The most important single contribution of this research on helminthic parasites was the discovery of the new hookworm, Uncinaria americana (Necator americanus), by Dr. C. W. Stiles, who demonstrated that this parasite was responsible for much of the illness of people in many parts of the South. A campaign for the eradication of hookworms was successfully organized and carried out in the South which resulted in tremendous improvements in the health and economic status of the people in rural communities. The success of this campaign later resulted in the sponsorship of a worldwide hookworm eradication campaign by the International Health Board.

1904. The nematode, Strongylus quadriradiatus (Ornithostrongylus quadriradiatus), was reported to cause losses among pigeons, and the tapeworm Devainea echinobothrida was demonstrated to be the cause of modular disease of the intestine of American chickens.

Accomplishments (Helminthological Investigations) - Continued

1905. The first well-authenticated case of gid in sheep was reported from the United States and in 1910 the coyote was found to be the host of the adult tapeworm, Multiceps multiceps, the distribution of the parasite in the United States was ascertained, and a Federal quarantine on imported sheep dogs was established to prevent the introduction of dangerous worms.

1906. The life history of the large stomach worm of sheep, Haemonchus contortus, was described and in 1910 the first program for the control of this parasite was proposed. In 1942 the injury produced by this parasite was shown to be largely due to gastric hemorrhage.

1907. The development in the host's intestine of adult nematodes of the genus, Strongyloides, following cutaneous infection was reported.

1911. The investigation of beef measles was begun to determine meat inspection procedures to be used for its detection. In 1914 a method for the destruction of Cysticercus bovis in beef was developed which enabled many carcasses to be saved that previously were condemned as unfit for human food.

1911. The discovery of the life history of a stomach worm of horses, Habronema muscae, enabled European and Australian scientists to solve the problem of the cause of "summer sores" in horses. The larvae of this parasite were found to develop in house flies.

1914. The destruction of trichinae by refrigeration of infected pork was reported as a control measure for trichinosis. In 1919 the thermal death point of trichinae was established and regulations were formulated for the proper handling of cooked pork products in packing houses. In 1920 methods of curing pork were ascertained as effective in destroying trichinae and studies were published showing that these parasites could be attenuated or killed by irradiation with x-rays. (IT IS SIGNIFICANT TO NOTE THAT PRIOR TO THE DEVELOPMENT OF THE PROCEDURES NOTED ABOVE, NO SATISFACTORY METHOD FOR DESTROYING THESE PARASITES IN MEAT AND VISCERA WAS AVAILABLE FOR COMMERCIAL USE.)

1917. The large roundworm of swine, Ascaris lumbricoides, was shown to have a direct life history and its larvae were found to be the cause of serious or fatal pneumonia in young pigs. In 1919 these larvae were reported to be the cause of so-called "thumps" in baby pigs and in 1927 the McLean County Swine Sanitation System for the control of large roundworms and other parasites of hogs was developed.

1919. Turkeys were found to be largely responsible for the infection of chickens with gapeworms, parasites that were relatively nonpathogenic to turkeys but were extremely injurious to chickens. These studies played an important role in the development of effective control measures for this parasite.

Accomplishments (Helminthological Investigations) - Continued

1920. The Intestinal nematode, Cooperia punctata, was shown to be the cause of severe lesions of the digestive tract in calves which often resulted in serious injury and death. Studies on the toxins of parasitic worms and their effects on the blood of the host were also published.

1922. The intestinal threadnecked worm, Nematodirus spathiger, was reported to cause serious injury to sheep, and in 1953 the results of experimental studies on the pathogenicity of this parasite confirmed the earlier observations.

1923. The first successful experimental intrauterine infection of pups with dog ascarids was reported.

1924. Nodular typhilitis of pheasants was found to be caused by a nematode, Heterakis isolonche, and in 1925 Heterakis biramporia was reported to cause intestinal nodules in chickens.

1926. The trematode involved in salmon poisoning in dogs was first described.

1928. The first comprehensive work on the nematodes of pathological significance in some economically important birds in North America was published.

1930. Descriptions of the pathological conditions of poultry that are ascribed to nematodes were published.

1931. The feeding habits and pathogenicity of the large-mouthed bowel worm of sheep, Chabertia ovina, were described.

1934. A new nematode, Stephanofilaria stilesi, causing a skin disease of cattle in the United States was reported. Studies on the intestinal threadworm of swine, Strongyloides ransomi, with suggestions for its control were published, and in 1943 the extreme pathogenicity of this parasite was verified experimentally.

1938. Information on the intermediate hosts of poultry tapeworms was published that was essential to the development of control measures against these parasites.

1939. The first studies were made in the United States on the effects of infections with gastrointestinal nematodes on the host's nutrition. The pathogenicity of intestinal hairworms in sheep was also demonstrated experimentally. Information on the survival and localization of the microfilaria of the dog heartworm in the host and on the nematodes of domestic fowl that are transmissible to wild game birds was published.

1940. Studies indicated that the red stomach worm of swine was not severely pathogenic unless present concurrently with other disease agents.

Accomplishments (Helminthological Investigations) - Continued

1941. Garbage-fed hogs were found to be infected with trichinae more frequently than were grain-fed hogs. The enforcement of legislation requiring the cooking of garbage intended for feeding to swine reduced infection in the swine fed the cooked garbage. The lancet fluke was first reported in domestic ruminants in the United States and its dangerous potentialities were pointed out.

1942. The first comprehensive study of the incidence of parasites of cattle in the United States was made in the southeastern states.

1943. The first experiments on the fumigation of soil to destroy larval stages of animal parasites were conducted.

1944. The first studies on the effects of Trichostrongylus infections on the nutrition of sheep were published.

1946. The important relationship between diet and the pathogenic effects of hookworms on sheep was demonstrated.

1948. Skin diseases of domestic animals caused by nematodes were described, the effect of internal parasites on the utilization of feed by swine was demonstrated, and a large percentage of cases of icterus in slaughter hogs was found to be caused by the plugging of the bile ducts by migrating large roundworms.

1948. Wild rabbits were found to serve as reservoir hosts of the common liver fluke of ruminants. This was recognized as a vital factor in the control of this parasite in endemic areas.

1951. Studies on the pathogenicity of the common sheep tapeworm, Moniezia expansa, were published.

1953. The threadnecked worm, Nematodirus spathiger, was shown to be very pathogenic to sheep. Cattle in the South were found to be adversely affected by large numbers of immature gastrointestinal nematodes, that could only be detected by a careful postmortem examination.

1954. The intestinal threadworm was shown to be the cause of death of calves.

1955. The stomach hairworm was found to be very pathogenic to calves.

1956. Studies on the course and pathogenicity of initial infections with cattle lungworms and on acquired resistance to this parasite were published. It was also shown that one species among those involved in multiple worm infections of the digestive tract of sheep may react with the others so that one or more of the other species is eliminated from the host. Studies in calves, however, showed that infections with two or three species of gastrointestinal helminths are more pathogenic than numerically equal infections with single species.

Accomplishments (Helminthological Investigations) - Continued

1958. The intestinal threadworm of sheep was found to be a factor in the production of dysentery and to be responsible for lung hemorrhages and anemia in sheep and goats.

1958. Transmission experiments demonstrated that the red stomach worm of swine will produce severe lesions in the abomasum of calves.

1959. Studies indicating that a rather high degree of immunity to cattle lungworms was conferred on calves by the administration of small doses of normal infective larvae.

1959. As of September 1959 this group had described an estimated 58 new genera and 216 new species of helminths. Fully one-fourth of these parasites are found in our domestic animals and poultry.

1960. It was discovered that the age of infections of Cysticercus bovis in cattle that were less than eight weeks old could be ascertained by studying the stage of development of the cysticercus. The size of the cyst was of little value in making this determination.

1960. Eggs of Taenia saginata on stored hay were found to survive three weeks under normal storage conditions and to resist exposure to freezing at 24 degrees F. for about two weeks. None survived storage for 10 weeks and very few survived exposure to 24 degrees F. for 11 weeks.

1960. It was also demonstrated experimentally that concurrent infections with the large stomach worm, Haemonchus contortus, and the intestinal threadnecked worm, Nematodirus spathiger, increased the severity of the disease caused by equivalent numbers of each species alone.

1961. A new species of tapeworm, Cladotaenia (Paracladotaenia) cathartis was described from the turkey buzzard, Cathartes aura septentrionalis.

1961. The cockroaches Periplaneta americana and Supella supellectilium were found to act as carriers of the poultry gapeworm Syngamus trachea.