whilst H. musculosum, from Sterna bergii, finds its nearest relative perhaps in H. bursigerum, found in several of the Lariformes. The European Hemistomum spathula, in various members of the Strigiformes, is represented in Australia by Hemistomum triangularo and Hem. brachyurum, found respectively in Dacelo gigas and Ninox maculata, whilst Strigea promiscua, found in two species of Ninox, in Queensland, comes near to Strigea gracilis, which occurs in certain species of Anseriformes in Europe.

Hemistomum intermedium parasitic in the Australian black swan, Chenopis atrata, seems to have no near relative.

Apart from the chelonians, very few trematode or cestode parasites, have been described from Australian reptiles, so that I propose to omit any mention of them for the present.

Cestodes from Amphibia.

The amphibia seem to be remarkably free from cestode parasites, for up to the end of the nineteenth century only one adult cestodes was known from this class of host, viz., Nematotænia dispar, which has been recorded from Rana temporaria, Bufo vulgaris, B. viridis, Pelobates and Hyla arborea. But closely related forms have recently been described from other amphibia, Ichthyotænia schultzei from Rana adspersa in South Africa, Ophiotænia filaroides from Amblystoma, and O. lonnbergii from Necturus in America, and Ophiotænia from Hyla aurea in Australia.

Larval tapeworms, Sparganum or Ligula, occur both in Australia and European frogs.

Trematodes of Amphibia.

But the trematodes differ from the cestodes widely in regard to their success in parasitising amphibia, for the frogs and toads present an abundant trematode fauna, which invade all parts of their alimentary tract and its offshoots.

The three European species of Pneumonœces found parasitic in the lungs of frogs are represented in Australia by one species of the same genus, in America by six species and in Asia by one. The single species of Halipegus, found in the buccal cavity of frogs in Europe is represented in Asia and America by one species each, but up to the present no representative of this species has been found in Australia. The European Opisthioglyphe, parasitic in the intestine, is represented in America by one species of Glypthelmens and in Australia by three species of Dolichosaccus and two species of Brachysaccus, the latter usually occurring in the rectum, but also found in the small intestine. Four species of Mesocœlium parasitic in the intestine of Australian frogs correspond very closely to one species of Mesocœlum in Asia, and one each of Brachycœlium in Europe and America. Also found in the intestine are seven species of the sub-family Pleurogenetinæ, belonging to the genera Pleurogenes, Prosotocus and Brandesia in European frogs; one species of Loxogenes in America and two species each of Pleurogenes in Asia and Australia.

The single species of Diplodiscus occurring in the rectum of European frogs is represented in America by one species of the same genus, and in Australia by two.

The members of the sub-family gorgoderinæ which occur in the bladder of frogs are represented in Europe by fine species of Gorgodera and Gorgoderina, in America by five species of the same genera, and in Australia by one of Gorgodera.

The heterocotylean Polystomum integerrimum occurring in the bladder of European frogs is represented in Australia by one species and in America by two, but the last, however, are parasitic not in frogs, but in Chelonians.

All the Asiatic species referred to are parasitic in frogs that occur in the Indo-Malayan region.

The trematodes or the cestodes parasitic in any given class of host may be separated into two groups, one in which the members have near relatives in the same class of host found distributed in other zoogeographical regions, another in which the members have no such relatives. The latter, which in some cases may have no members, e.g., in the case of the parasites of the frogs, may represent recent acquirements. The members of the former group represent very old parasites of their hosts. Looking on all the the related forms in one class of host, e.g., the pleurogenetines of frogs, as a stock derived from common ancestors, these ancestors must have become parasites of the ancestors of those hosts, in times far past, when the latter group of animals was in a very much more primitive and homogeneous state than we find it to-day, and when its distribution was very different, and very much more restricted. As this primitive group of animals became dispersed over various parts of the earth's surface the parasites were carried with them; but owing to the conditions under which their life is passed, cut off to a large extent from the shaping influences of changes of environment and, perhaps, to some extent, owing to a certain want of plasticity through their being a much older group of animals the parasites have become altered in their morphological structure much less than their hosts have. Thus we find in the case of the Sirenia that, while the hosts have diverged to the extent shown by the differences of the dugong and the manatee, the parasite Opisthotrema has not been affected even to the extent of specific differences: and again in the case of the Ratitæ, while the hosts have become so different as the ostrich, the rhea and the emu, the Davainea parasitic in them has only developed slight specific differences in the case of the form living in the emu.

Worm Parasites in Tropical Queensland.

Dr. W. Nicoll (Townsville), in his remarks on the worm parasites of Tropical Queensland, said: The study of worm parasites has made considerable advance throughout Australia during the past five years. Previous to 1909 comparatively little was known with regard to them. Although a few desultory papers had appeared no Australian worker had made any extended investigations on the subject. It must not be forgotten, however, that a few years earlier J. P. Hill had made a considerable collection of worm parasites from native animals, but his interest in them yielded to more alluring subjects, so that many of them remain undescribed, or have been described by other authors. The researches of Krefft and of Bancroft, in Queensland, must also be remembered. They were practically the pioneers of systematic helminthology in Australia, though unfortunately their work has little permanent value.

T. H. Johnston and Georgina Sweet made the first real advances. S. J. Johnston and J. B. Cleland have also made valuable additions to our knowledge.

The foundation of the Australian Institute of Tropical Medicine in 1910 provided an opportunity for the study of these parasites in tropical Queensland. This was taken advantage of by Breinl, and the extended investigation which he then commenced has been continued during the past four years, with the result that a large and representative collection of worm parasites has been gathered together. These include forms from all classes of vertebrates, but birds, being most readily procurable, have received probably the greatest share of attention.

Systematic work on this collection was undertaken by T. H. Johnston, S. J. Johnston, Breinl, and myself, and already eight reports have been published. These deal with a large number of species, most of which are new, and many of considerable morphological interest.

This paper is not intended to be a catalogue of the worm parasites occurring in North Queensland, but will consist merely of a few scattered remarks which it is hoped will stimulate some interest in the subject.

Compared with the conditions in other tropical countries, worm infection in human beings in tropical Queensland is relatively infrequent. This is undoubtedly due, in great part, to the absence of a large native population. Probably the most common human parasites in North Queensland are the hook-worms (Ankylostoma duodenale and Necator americanus), both of which abound in certain coastal districts, and are responsible for a large amount of sickness, especially amongst children. The common thread-worm (Oxyuris vermicularis) is fairly widely distributed, while the whip-worm (Trichuris trichiura and Strongyloides stercoralis) are not infrequently met with. The ordinary round-worm (Ascares lumbricoides) appears to be quite uncommon. Filaria bancrofti is one of the most frequent human parasites in this region.

Tapeworms are not at all common, and of the few cases which have been met with some have certainly been imported, Hitherto only Taeniarhynchus saginatus has been met with. Hydatid disease is also uncommon compared with its frequency in other parts of Australia. No flukes have as yet been recorded.

The parasites of the domesticated animals and stock have not hitherto received much attention, and in consequence our knowledge of them is scanty. In the dog the most characteristic parasites are Dirofilaria immitis and Ankylostoma caninum. The former affects the heart, and is the apparent cause of a considerable amount of mortality. Ascarids are not uncommon, while the most frequent tapeworm is Dipylidium caninum. The last-mentioned species is probably the most common parasite in cats here.

The parasites of horses, cattle, sheep and goats have not been much investigated, the only parasite to receive much attention being Onchocerca gibsoni, the cause of worm nodules in cattle, which is so widespread throughout Queensland.

With regard to other mammals, rats have naturally been most frequently examined. Their parasites do not differ from those occurring in rats in other parts of the world, but the characteristic feature here is the frequency of Gigantorhynchus moniliformis.

Of the marsupials, several grey and red wallabies have been examined. Their stomachs are frequently found crowded with two hitherto unidentified species of Nematodes.

Amongst the few parasites which have been collected here from the common opossum (Trichosurus vulpecula) is Filaria trichosuri, from the body cavity. Intestinal parasites do not appear to be common in this animal.

Only one parasite, a tapeworm (Cittotaenia tachyglossi) has yet been described from the echidna in this locality, but a second undescribed species of the same genus has been found, while an interesting small nematode occurs not infrequently. It is a little red worm which attaches itself firmly to the wall of the intestine, and assumes a characteristic spiral form which is extremely difficult to unwind. Unlike most nematodes, when treated with hot alcohol, this form does not straighten out but retains its coiled shape. It is somewhat remarkable that this worm bears a close resemblance to other similar species occurring in the flying-fox (Ptuopus gouldii), the carpet snake and a few other reptiles.

Not the least interesting of the mammalian parasites is the trematode (Rhabdiopoeus taylori), described by S. J. Johnston from the dugong. It presents an entirely new and highly characteristic type of structure.

Turning now to a consideration of the parasites of birds, we find a very large number and variety. When we consider, however, that a considerable proportion of Australian birds are migratory, and are widely distributed throughout Europe and Asia, it is not surprising to find that their parasites do not differ greatly from those occurring in Europe. It thus happens that the bird parasites do not present any very distinctively Australian characteristics. In 1910, T. H. Johnson gave a good summary of the worm parasites of Australian birds, and since then he has added numerous records, chiefly of tapeworms, to the list. Several of these were collected in North Queensland, but none of them seem sufficiently remarkable to call for comment. As is usualy the case, the hymenolepid family is by far the most strongly represented.

Several flukes have been recorded from birds by S. J. Johnston and myself, the most interesting of which are a new monostome from the native companion, and two new liver flukes from the stone-curlew and white ibis. Of the bird trematode-fauna the chief characteristic is the prevalence of echinostomes and holostomes, of which numerous varieties occur, closely allied to their European congeners.

With regard to the nematode parasites of Australian birds we possess little exact knowledge, and there are only a few scattered records relating to North Queensland birds. The best known forms are Oxyspirura parvovum (the eye-worm), Heterakis papillosa, and H. perspicillum, all of which are common here in chickens. Breinl has described a second eye-worm from Leach's Kingfisher. Other eye-worms have been met with in the wedge-tailed eagle and the brown hawk. The bulk of the nematodes collected from birds here belong to the families Ascaridæ and Filariidæ, and do not appear to possess any outstanding peculiarities.

The parasites of reptiles and frogs present a much more typical aspect, and several interesting new forms have been discovered in North Queensland. Amongst these may be mentioned two interesting new flukes, which have been described from the intestine of the carpet snake and freshwater turtle respectively. Several other new types have been collected from various reptiles, but still remain undescribed.

Of adult tape worms infecting reptiles only two have been recorded here, namely, Acanthotænia tidswelli and Bothridium pythonis. Species of larval sparganum are, however, extremely common in the subcutaneous and peritoneal tissues of monitors and various snakes. In some cases the infection with these parasites is so heavy that an almost continuous layer of tapeworm is formed, extending over the greater part of the body and into the limbs.

The nematode fauna of reptiles is interesting, and presents considerable variety, but it does not appear to differ essentially from that occurring throughout the rest of Australia. The most interesting nematode perhaps, which is common here, is that described by Breinl from the lungs of the blue-tongued lizard (Tiliqua scincoides).

It is amongst the fishes that we find the most remarkable and distinctive parasite fauna, and it is chiefly in regard to the intestinal flukes that the great profusion occurs. Tapeworms, in teleostean fishes at least, are very common, but the nematode parasites present one or two features of interest.

S. J. Johnston has already reported the occurrence of two new forms (Petalodistomum) from the stingray, while I have collected new and unusual types from the toad-fishes, the black bream, the grunter, the pilot fish and several others. Each of these presents features which are quite unlike those of any already known fish parasite.

Of nematodes the usual crowd of indeterminable larval forms occurs in the body cavity of numerous fishes. A more characteristic and unusual feature is the presence of large filariæ in the body cavity of such fishes as toadfishes, kingfish, eels and a number of others. These parasites often grow to large dimensions, and are usually turned around the genital glands. A moderate number of echinorhynchs have been collected, and of these the most remarkable is a comparatively enormous species from the swim-bladder of a black bream.

Onchocerca Gibsoni.

In speaking of the migration of the larvæ of Onchocerca gibsoni through the capsule of the worm nodule in cattle, Dr. W. Nicoll (Townsville) pointed out that while the morphology of the nematode, Onchocerca gibsoni, had been fairly exhaustively investigated, its mode and place of entrance into the host, its migration and the migration of its larvæ were still uncertain. Johnston had come to the conclusion that the most likely transmitting agents were mosquitoes, true lice or a cattle fly (Musca sp.). Cleland had made the discovery of the infection of calves born and bred on Milson Island, Hawkesbury River, with onchocerca. The mothers were not infected. He was able to show that the infection was not water-borne. He attached importance to Stomoxys calcitrans as the probable vector. Gilrutt and Sweet had arrived at negative conclusions. Breinl showed that the larvæ could make their escape from the worm nodule, and by piercing the skin of their host find their way to the exterior. In his latest paper, Cleland had brought forward fresh evidence in favour of the Stomoxys calcitrans theory. He suggested that the formation of nodules was an accident in the life-history of the worm and the larvæ were produced while the worm was free. Dr. Nicoll recounted a series of experiments undertaken by himself. Two moderately infected cows were used. In each, several palpable nodules were present. In spite of all the precautions taken the larvæ did not appear to penetrate the intact skin, when in contact with water. The results of his experiments did not in any way