

## NOTES ON SOME ENTOZOA.

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(Plates II, III, IV, V).

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*Read before the Royal Society of Queensland, 26th June, 1912.*

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*Ophiotaenia hylæ*, n. sp.

(Pl. II ; Figs. 1, 2).

Host :—*Hyla aurea* ; specimens collected by Dr. S. J. Johnston, of Sydney University, from frogs captured in the neighbourhood of Sydney.

Length, over 6 cm. ; greatest breadth, about .75mm.

The scolex is a rounded unarmed structure, .32 mm. in width, with four suckers, each about .11 mm. in diameter, and a rudimentary apical sucker or muscle plug. There may be a slight neck-like constriction, succeeded by a relatively long unsegmented region of about the same breadth as the scolex. Segmentation is of the usual type seen in the Proteocephalidæ. The proglottids do not project laterally, nor do they vary much in width after sexual maturity has been reached. The genital pores are situated at about the middle of the segments and alternate irregularly.

The muscular, nervous and excretory systems are of the general Proteocephalid type. The testes consist of numerous vesicles of about .03 mm. diameter, arranged dorsally in two wide lateral fields between which lies the uterus. These fields extend almost from the anterior border of the segment to the ovary. The vas deferens may be recognised as a coiled tube in the middle of the proglottis, lying above the uterus and passing laterally in close coils above and parallel to the vagina until it enters the cirrus sac within which the vas becomes thrown into



a few rather wider convolutions. The greater part of the sac is occupied by the wide eversible unarmed cirrus which is capable of being everted to a length of .20 mm., its width in such a state being about .033 mm. The cirrus sac, when the cirrus is at rest, is a pyriform organ .14 mm. long and about .055 mm. wide in its inner portion. The male pore lies postero-dorsally to the female aperture, both terminating in a very short genital cloaca.

The large bilobed ovary consists of numerous tubes whose terminations lie dorsally, the ovarian bridge being ventral. Its duct is short. Situated dorso-laterally in the cortex in the region of the longitudinal nerve are the vitelline follicles, each with a diameter of about .013 mm.

The vagina is a wide tube lying antero-ventrally to the cirrus sac, narrowing somewhat as it passes inwards below it and the vas deferens to bend backwards and travel above the uterus. Just in front of and above the ovary, there is a slight enlargement, the receptaculum seminis, followed by a narrowed portion or fertilising duct into which the oviduct enters. The shell gland lies in this region. The uterus arises as a thin duct which passes forwards ventrally, along the mid-line, below the ovary and the vagina. Numerous short lateral diverticula appear at an early stage, and as egg-formation proceeds, these become much more prominent, until at length the uterus appears as a much-branched structure almost filling the medulla. The eggs measure from 15 to 19 micra in diameter, and the oncospheres from 7.5 to 11 micra. Vitellaria persist even in segments with fully formed embryos.

*Ophiotænia hylæ* appears to be the first adult cestode described from an Australian amphibian.

La Rue (1911, p. 473), has recently subdivided the genus *Proteocephalus*, one of the genera being *Ophiotænia*, to which our form belongs. The differences between *Acanthotænia* and *Ophiotænia* are very slight. The latter might even be regarded as a subgenus of the former.

*Acanthotænia gallardi*, Johnston.

(Pl. II ; Figs. 3, 4).

This cestode was described by me last year (1911a, p. 175), under the name *Proteocephalus gallardi*, mention being made (p. 181) that it belonged to the subgenus



*Acanthotænia*. La Rue (1911) has recently dealt with the Proteocephalidæ, and has restored Linstow's name (Johnston, 1909, pp. 112, 114) to full generic rank. He includes all the known Proteocephalids from amphibia and snakes under *Ophiotænia*, a genus whose members do not possess the tiny cuticular spines which occur on the anterior end of species of *Acanthotænia*. Our form which infests several species of Australian venomous snakes, is, however, a typical *Acanthotænia*. It was originally described from *Pseudechis porphyriacus* and very shortly afterwards (Johnston, 1911b, p. 239) was recorded from the tiger snake, *Notechis scutatus*, mention being made that a closely allied species parasitised two other snakes, *Denisonia superba* (p. 239) and *Pseudechis australis*. A careful comparison has led me to consider that all four snakes harbour the same species of cestode. The main difference seen is in regard to the number and shape of the testes, but the former is variable, while the elongate form of the glands as seen in specimens from the two last named snakes, is apparently due to imperfect preservations, both series of specimens having been taken by me from the intestine of reptiles which had been preserved for some time in alcohol. The arrangement of all the organs as seen in transverse sections, agrees entirely with that already figured (1911a, pl. vii., figs. 2, 3.)

*Acanthotænia tidswelli*, Johnston.

Specimens of this tapeworm which is known to occur in *Varanus varius* (Johnston, 1909, p. 103), and in *V. gouldii* (1911b, p. 242), have been collected from Bell's monitor *V. bellii*, forwarded by Dr. T. L. Bancroft, from Eidsvold, Burnett River. This reptile harboured in its stomach several nematodes, *Physaloptera varani*?, similar to those already recorded from the two above-named lizards, while in its blood there were present hæmogregarines, *Hæmogregarina varanicola*.

Some authorities regard *V. bellii* as being only a well-marked variety of *V. varius*.

*Hymenolepis diminuta* (Rud.)

From rats, thus *decumanus* and *M. rattus* (*Alexandrinus*) caught in Brisbane. Not previously recorded from Queensland.



*Hymenolepis carioca* (Magalh.)

From a domestic fowl, Brisbane. Not previously reported from Queensland.

*Hymenolepis megalops* (Nitzsch).

This species has been identified from material collected from a Black Duck, forwarded by Dr. Bancroft, Eidsvold and is now definitely recorded from this State.

A new host for this parasite is the Teal, *Nettion castaneum*, specimens having been collected by Mr. C. J. Woollett near Cobar, N.S. Wales.

The parasite under review was described by Krefft (1873, p. 220 ; Johnston, 1912, p. 33) as *Tænia cylindrica*, and is quite a different form to that described under the same name by Clerc (1902, p. 661), whose specimens came from a gull *Larus canus*. Clerc's species has been listed as *Dilepis* ? *cylindrica* and *Choanotænia* ? *cylindrica*, but since the specific name was already preoccupied in *Tænia*, the name *clerci* might be substituted for it. (*Tænia clerci* = *Choanotænia* ? *clerci*, nom. nov.)

*Diorchis flavescens* (Krefft).

Found by me in a Black Duck, *Anas superciliosa*, shot on the Burnett River. In company with this species of cestode were some trematodes, *Echinostoma* sp. (*sensu lato*).

*Amæbotænia cuneata* (Linstow).

Found in some fowls in Sydney and also in Brisbane. This small parasite had not been recorded as occurring in Australia.

*Bancroftiella glandularis* (Fuhrmann).

This cestode was originally described by Fuhrmann under the name of *Anomotænia glandularis*, from *Herodias timoriensis*, his material being collected in the East Indies. It is now recorded as infesting the Blue Crane, *Notophox novæ-hollandiæ*, my specimens being collected by Dr. S. J. Johnston near Gosford, N.S. Wales. I have the same species from this host from Queensland.

It belongs to the genus *Bancroftiella* (Johnston, 1911c, p. 50).



*Tænia crassicollis*, Rud.

Found in a local cat (Brisbane). Not previously recorded from Queensland.

*Cysticercus fasciolaris*, Rud.

This bladderworm stage of *Tænia crassicollis* is fairly commonly met with in the liver of local rats (*Mus decumanus* and *M. alexandrinus*) and mice (*M. musculus*), but its presence in Queensland does not appear to have been reported.

*Dipylidium caninum* (L.)

A common parasite in local dogs and cats (Brisbane), but apparently unrecorded from this State.

*Diploposthe lævis*, Bloch.

This large and interesting cestode has again been met with in a White-eyed Duck, *Aythya australis*, kindly forwarded by Dr. Bancroft from Eidsvold. It is now definitely recorded from Queensland. Krefft, who described the parasite as *Tænia tuberculata*, did not refer to a definite locality, mentioning merely that his material was collected in either New South Wales or Queensland.

*Metroliasthes lucida*, Ransom.

Found in the domestic turkey, my specimens being collected in Sydney from material supplied by Mr. Thos. Steel, through the Bureau of Microbiology, Sydney. This identification constitutes the first record of the occurrence of the species in Australia.

*Davainea cesticillus*, Molin.

Has been identified from a local fowl (Brisbane). Not previously recorded from Queensland.

*Davainea tetragona*, Molin.

Has been found several times in local fowls (Brisbane). This species has been previously recorded by Dr. Sweet (1910, p. 243), as occurring in Rockhampton.

*Davainea varians*, Sweet.

This tiny parasite of domestic fowls has been described by Dr. G. Sweet (1910, p. 243), but it seems to me to be synonymous with *D. proglottina*, which is admittedly a variable species. The main difference appears to be in the size



and form of the rostellar hooks, but it is often a difficult matter to figure these quite accurately, and the differences are small. The general anatomy is similar to that of *D. proglottina*.

*Cittotænia bancrofti*, n. sp.

(Pl. V ; Figs. 42, 45).

This large cestode parasitises one of the small wallabies, *Onychogale frenata*, specimens having been collected for me by Dr. Bancroft (Burnett River District). The length is about 15 cm. and the maximum breadth 14 mm. The unarmed scolex is large, being 1.9 in diameter, and bears four powerful suckers, each about .72 mm. in diameter. There is no unsegmented neck region, the strobila consisting of very numerous narrow leaf-like segments, which gradually increase in length and breadth as they pass backwards. The genital papilla lies in the posterior half of each margin.

The longitudinal musculature is very powerful, consisting of a broad zone of bundles lying in the inner portion of the cortex, the outer portion being free from them. The bundles on the outer edge of the zone are smaller than those lying nearer the well-developed transverse muscles. Dorso-ventral fibres are abundant. The dorsal excretory vessel is a small tube situated laterally from the larger ventral canal. The nerve lies just above, or at times dorso-laterally to, the dorsal vessel. The sex canals pass above both the excretory canals and the nerve, the male duct lying above the vagina. Both sex canals terminate in a common genital chamber which communicates with the exterior through the genital pore.

Testes were not distinguishable in the specimens. There is a large cirrus sac in each half of the segment. Its length when the cirrus is at rest, is from .8 to 1 mm., and the breadth .019 mm. It possesses relatively thick muscular walls. The vas deferens forms a small closely-coiled mass near the inner end of sac, and after entering the latter, enlarges to form a vesicula seminalis. The cirrus may be everted to a distance of .30 mm. beyond the genital pore. It then appears as a wide organ (.14 mm. in width), covered with very numerous tiny spines so closely set as to give a stippled appearance.



The female organs are duplicated and are somewhat obliquely placed. The inner and anterior portion of the female complex consists of the ovary, while the more laterally situated posterior division consists of the vitellarium. Separating the two is the receptaculum seminis. The vagina travels inwards behind and below the cirrus sac in a slightly sinuous course, becoming widened in its progress, its inner portion being the widest portion. As already mentioned, this receptaculum lies above and anterior to, the yolk gland. Each uterus arises as a transverse tube from which numerous processes or pouches develop anteriorly and posteriorly. The two uteri extend medianly and eventually almost touch. I have not determined whether they ultimately fuse or not.

The above description is of a preliminary nature.

*Dibothriocephalus felis*, Creplin.

This cestode is met with occasionally in cats. In addition to specimens from Queensland, I have others collected in Melbourne, in Sydney, and near Gosford, New South Wales.

Cysticeroids of *Hymenolepis diminuta* and *H. murina*.  
(Pl. III; Fig. 11).

During the time that I was associated with the Government Bureau of Microbiology, Sydney, I had opportunity of examining some thousands of rat-fleas, the species represented being almost entirely the three common fleas infesting *Muridæ*, viz., *Xenopsylla cheopis*, *Ceratophyllus fasciatus* and *Ctenopsyllus musculi*. In the last-named species, no parasites were found, while in the two former there were met with occasionally two distinct species of Cysticeroids as well as larval nematodes to be referred to later. Rarely, both the nematodes and one or other species of Cystercoid occurred in the one host, and also rarely, both species of Cysticeroid in the same *Ceratophyllus*.

These cestode larval are identical with those described and figured by Nicoll and Minchin (1910, p. 9; text figs. 1, 2, Minchin, 1909, p. 741), who proved experimentally that they were the Cysticeroid stages of two common rat-parasites, *Hymenolepis diminuta* and *H. murina*. They were found only in *Ceratophyllus fasciatus* and in about



four per cent. of specimens examined. The former larva is pyriform, with an unarmed scolex and a fairly long tail, while the Cysticeroid of *H. murina* is rather broader and shorter, has scolex armed with small hooks and possesses a short thick tail.

*Xenopsylla cheopis* is thus a new host for these two larval forms, and the known geographical distribution is extended from Europe to Australia. As mentioned by Nicoll and Minchin, there is usually only one larva present at a time, but I have met with multiple infection. On one occasion there were found no less than nine Cysticeroids of *H. murina* (see Fig. 11) in a *Ceratophyllus fasciatus* taken from *Mas decumanus* in Sydney (1909); on another occasion three larvæ belonging to the same species were found in a *Xenopsylla cheopis* taken from *Mus rattus*, also in Sydney. One specimen, a *H. diminuta* Cysticeroid, was found in one flea, *C. fasciatus*, out of six sent to me in 1910 from Melbourne for identification.

The presence of these parasites was detected in specimens of fleas after clearing the latter and mounting them in long series in canada balsam.

A record of the per centage infection was kept, but it has been mislaid. It was, I believe, about the same as that already recorded.

*Sparganum*, sp.

(Pl. II; Figs. 5, 6).

Cestode larvæ (plerocercoids) occur occasionally in certain parts of the body, mainly in the thigh muscles, of some Australian frogs, e.g., *Hyla aurea* and *H. cœrulea*. I have examined specimens from the former host from Perth, West Australia, collected by Dr. J. B. Cleland, and from Sydney, N.S. Wales, collected by Dr. S. J. Johnston, and by myself; and also from the latter host from Sydney, and from the Burnett River, Queensland, collected by Dr. Bancroft. The figures have been drawn from a specimen mounted by Dr. S. J. Johnston.

The parasite has already been described by Professor Haswell (1890, p. 661), its occurrence in various localities having been noted by myself (1911b, p. 234). Prof. J. P. Hill (1905, p. 369) also has referred to it. The general



appearance of the anterior end is shown in Fig. 5. The width is fairly uniform (.7 mm.) throughout the greater part of its length, the broadest portion being anterior (1.4 mm.) The length varies somewhat, some of the complete specimens examined measuring 47 mm. The posterior end is rounded (Fig. 6), and bears the excretory pore lying at the base of a small depression. The body is imperfectly ringed, and the cuticle is also thrown into small folds.

Calcareous corpuscles are abundant. The longitudinal muscles are arranged in a series of well-marked bundles. The excretory canals lie deeply, each being distant from the margin about a third of the body diameter. They join near the posterior end to form a very short common tube terminating at the excretory pore. The nervous system consists of a small mass just behind the slit-like depression at the anterior end, and of a pair of prominent laterally situated strands, as well as a pair of longitudinal nerves.

*Fasciola hepatica*, L.

Specimens of the common liver fluke were forwarded from Ipswich, having been taken from sheep and cattle.

*Heterakis chenonettæ*, n. sp.

(Pl. IV ; Figs. 31, 33).

Last year, I took from the cæcum of a wood duck *Chenonetta jubata*, near Sydney, a number of specimens of a small *Heterakis*, which appear to belong to a new species. The dimensions are :—Male—length, 6.8 mm. ; breadth, .19 mm. ; female—length, 7.7 mm. ; breadth, .26 mm. This species is thus slightly longer than *H. bancrofti*.

The cuticle bears very fine annulations. The anterior end tapers rather rapidly from region of the nerve ring, while the posterior portion of the worm becomes gradually narrowed to terminate in small fine tail. The lips are equal in size, but are small. The excretory pore lies at .422 mm. from the head end, in the same region as the nerve ring. The vulva is situated just behind the middle of the body (4.2 mm. behind the head). The anus in the female lies at .53 mm. from the posterior end.

The tail of the male terminates in a fine point. The alæ are prominent and bear nine pair of papillæ, whose position is indicated in Fig. 30. Four pair are pre-anal



three pair lying just in front of and laterally to the prominent cloaca, while one pair lies laterally from the sucker of the post-anal papillæ; three pair are almost caudal in position. The sucker is situated at a considerable distance (.194 mm.) in front of the cloaca, and appears as a prominent organ. The spicules are 1.17 mm. in length, and .013 mm. in breadth. The longer male spicule is strongly curved, and has a fairly uniform breadth (.008 mm.), but tapers slightly towards the extremity. The length is .48 mm. The shorter spicule has a length of .18 mm., and a breadth (in its midregion) of .012 mm., but the extremity is widened and rounded.

The uterus contains eggs with vermiform embryos.

*Heterakis bancrofti*, n. sp.

(Pl. IV; Figs. 28, 30).

The cæcum of the brush turkey, *Catheturus lathamii*, is commonly infested by small nematodes, which at first sight remind one of *Heterakis papillosa* of the fowl. Dr. Bancroft has forwarded me material from the Burnett River district, while Mr. R. Dart has sent me material from Laidley. From all of the specimens, this species of nematode has been taken. It is therefore a common parasite of this host. Occasionally one finds in company with it a much larger *Heterakis*, described below as *H. catheturinus*, as well as a *Tænia*-like species of *Echinorhynchus*, or, perhaps more correctly, *Gigantorhynchus*.

*Heterakis bancrofti* has the following dimensions:—male—4.3 mm. long and .22 mm. broad; female 6.25 mm. long, and .33 mm. broad. The anterior end tapers gradually while the tail of the female is rather short and sharply-pointed, that of the male being very narrow and delicate (Fig. 30). The vulva is situated at about the middle of the body, the excretory pore at .260-.265 mm. from the anterior end, and the anus (in the female) at .91 mm. from the posterior extremity.

There are three prominent lips of equal size, with deep notches between them. The alimentary canal is of the usual *Heterakis* type. The nerve ring surrounds the pharynx at .16 mm. from the anterior end, and is situated just in front of the excretory pore.



The male spicules are equal and relatively long ( $\cdot 860$  mm.), sharp-pointed structures, the points being turned backwardly. Their form is indicated in Fig. 30. The sucker is chitinated and possesses a diameter of  $\cdot 073$  mm. Its posterior margin is situated at about  $\cdot 035$  mm. in front of the cloaca. Lying between it and the cloaca is a pair of pre-anal papillæ. The disposition of the papillæ around the lobed alæ is indicated in the figure, there being two pair placed pre-anally, two pair post-anally, and two pair just near the junction of the alæ with the narrow pointed tail.

This species is associated with the name of Dr. T. L. Bancroft, who has rendered me considerable service in regard to material.

*Heterakis catheturinus*, n. sp.

(Pl. III ; Figs. 23, 25. Pl. IV ; Figs. 26, 27).

As already mentioned, this large species may sometimes be found in company with the commoner species, *H. bancrofti*, infesting *Catheturus lathamii*. My specimens have been collected from material forwarded by Dr. T. L. Bancroft from the Burnett River. Adult females may reach a length of 28 mm., males being somewhat shorter and attaining a length of 21 mm.

The anterior end is rounded and narrow, while the posterior extremity terminates in a short pointed tail in both sexes. The three lips are equal in size, their characters being indicated in Fig. 24. The excretory aperture lies at a distance of  $\cdot 8$  mm. behind the mouth. The vulva is situated at about the middle of the body length, on a slight elevation. The anus is distant from the posterior extremity  $\cdot 40$  mm. in the case of the male, and  $\cdot 86$  mm. in the case of the female. At each side of the anterior end of the parasite, there is a ridge or ala, arising laterally just behind the mouth and travelling backwards for about two millimetres. The cuticle bears fine transverse rings.

The alimentary canal is of the usual type, and is surrounded at  $\cdot 50$  mm. behind the mouth by the nerve ring.



The male spicules are slightly curved pointed rods, measuring 1.05 mm. in length, and .022 mm. in width. The male tail is not prominent, the alæ being narrow. The sucker lies at some distance (.275 mm.) in front of the cloaca. There are two pair of prominent pre-anal papillæ, a small unpaired median pre-anal, and a small unpaired post-anal papilla, followed by six paired post-anal papillæ, the arrangement of these sensory structures being indicated in the figure of the tail end of the male. (Fig. 25).

*Heterakis papillosa*, Rud.

A common parasite of poultry (Brisbane), but hitherto unrecorded from this State.

*Heterakis perspicillum*, Rud.

More commonly known as *H. inflexa*. A fairly common but apparently unrecorded nematode infesting local fowls (Brisbane).

*Heterakis spumosa*, Schneider.

Present in *Mus decumanus* and *M. rattus* (Brisbane). Not previously recorded.

*Belascaris mystax*, Rud.

Formerly grouped with an allied round-worm parasitic in the dog, under the name of *Ascaris canis*. This species was found in a local cat, and has not been recorded as yet from this State.

*Toxascaris canis*, Gm.

Occurs in local dogs (Brisbane), but is apparently unrecorded until now.

*Ascaris spiculigera*, Rud.

Numerous specimens were taken by me from the oesophagus and stomach of a cormorant, *Phalacrocorax sulcirostris*, and a darter, *Plotus novæhollandiæ*, shot on the Burnett River, Eidsvold, by Dr. Bancroft. *Ascaris*, sp., recorded by Krefft (1873, p. 213), from the latter host, belongs to the same species.

Some parasites which I have collected near Sydney from the pelican, *Pelecanus conspicillatus*, are referred to the same species. They are rather larger, but appear to be specifically identical with the above.



A larger species of *Ascaris* from the stomach of *Phalacrocorax carbo*, shot by Dr. Cleland on the Hawkesbury River, N.S. Wales, is of the same general appearance, but does not agree entirely with the available accounts of *A. spiculigera*.

*Amblyonema terdentatum*, Linstow (1898, p. 470).

This species of nematode has been found quite commonly by Dr. Bancroft and myself in the spiral valve of specimens of *Neoceratodus forsteri*, caught in the Burnett River. In company with it, on one occasion, there were found a few specimens of a small *Amphistoma*.

*Oxyuris obvelata*, Bremser.

Occurs in *Mus decumanus*, *M. rattus* and *M. musculus* in Brisbane. Not previously recorded.

*Trichosoma hepaticum*, Raill.

Found in the liver of *Mus decumanus*, *M. rattus* (*alexandrinus*), and *M. musculus* in Brisbane. Its presence in Queensland was recorded by Dr. Bancroft (1893b, p. 89), who described it from *Mus rattus* as *Trichocephalus hepaticus*. It was originally described by Railliet under the same specific name.

*Trichodes crassicauda*, Bellingham.

Occurs in the bladder of *Mus decumanus* (Brisbane). Not previously reported from this State.

*Spiroptera obtusa*, Rud.

From the stomach of *Mus musculus*, *M. alexandrinus* and *M. decumanus* in Brisbane. Apparently unrecorded from this State.

*Hystriognathus hystrix* (Cobb).

Cobb (1898, p. 315), originally described this species as *Xyo hystrix*, it being the type of his genus *Xyo*. A comparison of Cobb's figure with those given by Leidy (1853, Pl. 7, Figs. 8, 9, 10), leads us to synonymise *Xyo* with Leidy's *Hystriognathus*.

Dr. Cobb did not actually give an account of his form, but defined it by means of his "nematode formula" and a figure. The host is quoted as beetle, *Passalus*, sp. *H. hystrix* is a parasite of the large common passalid beetle, found in rotten timber, and identified for me by Mr. W.



Gurney, of the Entomologist's Branch, Sydney, as *Mastochilus*, sp. It is under this host name that these tiny nematodes should be placed.

My specimens were collected in various parts of New South Wales.

*Echinonema cinctum*, Linstow.

This roundworm was originally described as *Hoplocephalus cinctus*, by Linstow (1898, p. 469), from material taken in Queensland by Prof. Semon from a bandicoot, *Permaeles obesula*. It is now recorded, from the "native cat," *Dasyurus viverrinus*, my specimen of the parasite—a female—being collected from a dasyure secured by Mr. T. Steel, in a suburb of Sydney.

*Filaria websteri*, Cobbold.

This large nematode infests the bursa at the knee-joint of several kangaroos and wallabies. I have recently received specimens collected near Eidsvold by Dr. Bancroft from *Macropus giganteus*, *M. dorsalis*, and *M. parryi*.

*Habronema muscæ* (Carter).

The larval stage of this parasite, *Habronema muscæ*, has been met with in two species of flies, *Stomoxys calcitrans* and *Musca domestica* in Sydney, and in the latter in Brisbane. As far as I know, the larval form has not been previously recorded from Australia.

Ransom (1911, p. 690), has recently shown that *H. muscæ* is the larval stage of a parasite which infests the stomach of the horse.

A larval worm which has the general form and characters of the above species occurs in the head region of the common "cattle fly," found frequenting, especially the eyes of cattle, in Queensland and determined as *Musca vetustissima*. I am indebted to Dr. Bancroft for specimens taken near Eidsvold in the Burnett River district of this State.

*Filaria clelandi*, n. sp.

(Pl. II ; Figs. 7, 8).

A single specimen—a male—was found by Dr. Bancroft in the peritoneum of a magpie, *Gymnorhina tibicen*, shot near Eidsvold. Its length is 27 mm., and its breadth .62 mm. The cuticle is quite smooth. The ends are



somewhat similar in appearance both being obtusely rounded, but the tail end is broader. At the head end are three papillæ placed laterally, while surrounding the mouth are three very slight pit-like depressions, with each of which is associated a highly refracting rod-like structure, apparently of a chitinoid nature. This bifurcates, each branch being relatively long. These six rods come into relation with the anterior end of the alimentary canal, where it meets the mouth cavity which has thus something of the character of a mouth capsule. The alimentary canal is of the usual filarial type; the nerve ring surrounding it at a distance of .027 mm. from the anterior end of the worm. The anus is subterminal, lying at only .08 mm. from the posterior end.

No definite papillæ were recognised in the colocal region, though there appeared to be indications of a small pre-anal pair. The male spicules are relatively large and thick; the longer being .75 mm. in length, sabre-like, twisted and with a broad lancet-like termination; while the other is also long, but is bent in a remarkable manner to form an elongate S. The total length of the latter, including curves, is .60 mm. The general breadth of both spicules is the same (.025 mm.)

I desire to associate with this species the name of my friend and former colleague, Dr. J. B. Cleland. We have already described two forms of larval filariæ (Cleland and Johnston, 1910, p. 107), found in the blood of this host in N.S. Wales, but Dr. Bancroft (1889, p. 61), had already recorded the occurrence of larvæ in specimens taken in Queensland. Simultaneously with ourselves, Drs. Gilruth, Sweet and Dodd (1910, p. 236) described several different forms under the name, *Microfilaria gymnorhinæ*. It is inadvisable to confer specific names on larval filarial forms since it is not always an easy matter to associate a larva with the adult form; hence confusion in nomenclature is more likely. As the specific name given includes more than one form, there need be no hesitation in naming the adult male which has been briefly described above.

Plimmer (1912, p. 138) also mentions finding embryos in this host, his birds having died in the London Zoological Gardens.



*Microfilaria* sp.

(Pl. III ; Figs. 16, 17).

Filarial embryos have been found by Dr. J. B. Cleland and myself in *Plotus novæhollandiæ* and *Phalacrocorax sulcirostris*, both shot on the Burnett River by Dr. Bancroft. These larvæ are relatively long (.163 to .236 mm.) and narrow (.004 to .006 mm), with a rounded anterior end and a pointed posterior extremity. A sheath is present.

*Filaria* sp.

(Pl. III ; Figs. 14, 15).

I found several immature female filariæ encysted in the subcutaneous tissues of a "leather-head" *Philemon citreigularis* forwarded by Dr. T. L. Bancroft from Eidsvold. They were coiled up within fairly thick brownish cysts, only the head end protruding. Their length, when uncoiled, is 10 mm. The cuticle is very distinctly ringed, the ridges being similar in general appearance to those present in species of *Onchocerca*.

The anterior end is narrowed and bears six papillæ, while the posterior end is pointed. The anus lies at about .16 mm. from the latter. The nerve ring is situated at about .14 mm. from the head extremity. The mouth soon leads into the œsophagus which in its turn communicates with the intestine. The excretory pore is situated in the region of the nerve ring.

*Filaria*, sp.

(Pl. IV ; Figs. 37, 38).

A mature female worm, about 20 mm. in length, and .7 mm. in maximum breadth was taken by Dr. J. B. Cleland from the subcutaneous tissues of a honey-eater, *Acanthogenys rufigularis*, shot near Sydney, N.S. Wales.

The anterior end is narrowed but terminates abruptly, while the posterior extremity ends in a short bluntly-rounded tail. The cuticle is practically smooth. The three lips are not prominent, but each bears a tiny papilla. Lying at a short distance behind the mouth are the excretory aperture (at .14 mm.), and the female pore (at .24 mm.) Lateral lines are relatively broad, the excretory vessels travelling within them in a sinuous course. The



alimentary canal is of the usual filarial type, the œsophagus measuring .64 mm. in length. The anus lies very close to the posterior end, being only .130 mm. distant. The nerve ring is situated at .16 mm. from the anterior extremity.

The two uteri which contain eggs with vermiform embryos within them, join to form a very short vagina near whose external opening are gland cells. The eggs *in utero* measure .050 by .028 mm.

*Filaria physignathi*, n. sp.

(Pl. III ; Figs. 18, 22).

The presence of filarial embryos in the blood of *Physignathus lesueurii*, Gray, has already been made known (Johnston and Cleland, 1911, p. 489), while mention has been made (Johnston, 1911*b*, p. 241) of the fact that the adults were found in the mesenteric veins by Dr. Bancroft. These adult worms, mainly females, were forwarded to me and are now dealt with under the name of *Filaria physignathi*. Filarial embryos have been recently recorded as occurring in another Australian lizard, belonging to the same family, *Amphibolurus barbatus*, by Plimmer (1912, p. 139), whose specimens came from the London Zoological Gardens.

The dimensions of the new parasite are as follows :—  
Male 12 mm. long, and .20 mm. broad ; female, about 36 mm. long, and .33 mm. broad.

The following account is taken from a female. The diameter of the body is uniform, each end being bluntly rounded. Three small papillæ appear to be present at the anterior end. Lips are absent. The anus is terminal. The vulva is situated at about 1.40 mm. from the head end, and lies on the summit of a small elevation surrounded by a definite depression. The excretory pore lies in front of the nerve ring, at about .130 mm. from the anterior extremity. The cuticle is not transversely striated, but is smooth and thin.

There is no mouth cavity or pharynx. The œsophagus is .82 mm. in length, being surrounded at .180 mm. from the mouth by the nerve ring. Its front portion is rather wider than the remainder. Succeeding the œsophagus is the widened thin-walled intestine, which terminates at the anus at the end of the worm.



The female glands and ducts are very extensive, coils being present close to the anus, while the common uterus—a wide tube—terminates close to the anterior end, as already mentioned. The lower parts of the female canal are crowded with free embryos of the type already described as occurring in the blood. Surrounding the vulva are numerous vaginal glands. The female aperture is very narrow.

The male is quite small when compared with the female. The tail is spirally rolled. The cloaca lies at .097 mm. from the blunt posterior end. The nerve ring lies at about .130 mm. behind the mouth. A coil of the testis approaches quite closely to the region of the nerve ring. The alæ are very small and papillæ are poorly represented. There appears to be a pre-anal pair just antero-laterally to the cloaca, as well as two pair of post-anal papillæ just behind the cloaca. The spicules are rather small, the larger being .162 mm. long, slightly curved, and bearing a pointed extremity. The smaller is .081 mm. long, also slightly curved, but its extremity is widened, as often happens in Filariidæ.

The specimens were collected by Dr. Bancroft from the water dragon, *Physignathus lesueurii*, on the Burnett River, near Eidsvold.

*Oxyspirura anthochæræ*, n. sp.

(Pl. IV ; Figs. 34, 36).

As far as I am aware, no nematodes have been described as infesting the eyes of native birds in Australia. Krefft (1873, p. 213), recorded the presence of *Ascaris* sp. from the eye of a gill-bird, *Anthochæra carunculata*. I have already remarked (1910, p. 111), that the worms probably belong to the Filariidæ. An examination of Krefft's specimens, through the courtesy of the Curator of the Australian Museum, Sydney, shows them to belong to that family, and apparently to *Oxyspirura*. In my list of entozoa known to infest Australian birds, I have recorded this form as *Ceratospira anthochæræ* (1912b, p. 111). The position of the female pore is posterior instead of anterior, hence the species must be transferred to *Oxyspirura*.



The specimens had become dried up and are therefore of little value. The description given below is lacking in many details, but should allow the recognition of the species in the future.

The length of the male is about 8.5 mm., and of the female 8 to 9 mm. The breadth of each is about .11 mm. The cuticle is finely striated transversely. The head end has suffered in drying. Neither lips nor papillæ are recognisable on the rounded anterior extremity, which is slightly swollen when compared with the succeeding neck region. The posterior end of the female is sharp-pointed, the anus and the genital aperture lying at .194 mm. and .32 mm. distant, respectively, from the extremity. The cloaca in the male lies at .08 mm. from the tail end, which is spirally curved and is shorter than the female tail. No male papillæ were discernible.

A small mouth cavity is present. Surrounding the pharynx at a distance of .195 mm. from the anterior end, is the nerve ring.

*Larval nematodes in fleas.*

(Pl. III ; Figs. 12, 13).

As a result of examining a large series of rat fleas, as mentioned earlier, the presence of small coiled nematode larvæ, *Agamonema* sp., was detected in a goodly number of *Xenopsylla cheopis*, and—on only one occasion—*Ceratophyllus fasciatus*, all the parasitised fleas coming from Sydney and district. As far as I am aware, the presence of larval nematodes in fleas, has not been recorded. Usually, there was only one present, but sometimes two, three or four, while on one occasion, no less than six of them were present in the body cavity of a male *X. cheopis*. When compared with the size of the host, these larvæ are quite large as a glance at Fig. 12 will indicate.

In nearly every instance the parasite was closely, usually spirally, coiled and therefore very difficult to examine. Sometimes a relatively thick cyst enclosed it. Owing to their transparency, their presence is not detected unless the bodies of the fleas be either carefully teased up and examined in saline or other solution with a minimum amount of light, or the hosts be cleared and examined, very little light being allowed to pass through them. They



are delicate, practically colourless worms .43 mm. in length and .042 mm. in width, which is uniform throughout the greater part of the body. The body bears delicate transverse rings. The posterior end tapers rapidly to become pointed, while the anterior extremity narrows more slowly. The whole larva bears a striking likeness to *Habronema muscæ*. I therefore consider it to be the young form of a *Spiroptera sensu lato*.

The species of *Spiroptera* which infests rats and mice in Australia is *S. obtusa*. It is thus quite likely that the larvæ under review, belong to this species. The probability is suggested by the following facts:—*S. obtusa* is quite common here. Its eggs pass to the exterior with the fæces of the rat or mouse and come to reach the earth in the rat holes, or elsewhere where the rat-flea eggs are developing into larvæ. The latter are known to be able to ingest rat-cestode eggs with contained embryos, e.g., *Hymenolepis diminuta* and *H. murina* which also reach the exterior with the fæces. It is thus not unlikely that the life history of *S. obtusa* is different from that of *Habronema muscæ*, whose eggs become ingested along with organic matter in horse manure by the fly larvæ (*Musca domestica*, *Stomoxys calcitrans*, and probably other flies). Maturity is reached by the ingestion of the intermediate host by the definitive host. As already mentioned, the larva is of the *Spiroptera* form. It occurs fairly frequently, and is known to infest at least two species of rat fleas.

The objection is, that the parasite occurs chiefly in *Xenopsylla cheopis*, a flea which lives ordinarily in tropical and subtropical regions; and quite rarely in the common flea *C. fasciatus* which forms such a large percentage of the aphanipterous population of murids in temperate and subtemperate zones and in the colder periods of the year in sub-tropical areas. This objection does not appear to me to be a very serious one, as the parasite does not seem to have been recognised elsewhere, perhaps because unsuspected, perhaps because of the difficulty in seeing it unless very little light be allowed to pass through the specimen.

*Stephanurus dentatus*, Dies.

The "kidney worm" of pigs was recognised many years ago in Queensland by Morris, in 1871, and by Bancroft



(1893a, p. 258). My specimens were forwarded from Ipswich. Immature forms have been found by me in the liver.

*Agchylostoma caninum*, Ercol.

Found locally in dogs and cats. Its presence in dogs in Brisbane (presumably), is inferred from a statement by Dr. Bancroft (1901, p. 41), while I have recorded its occurrence in the dog in N.S. Wales and Victoria. As far as I am aware, this hook-worm is now recorded for the first time as parasitising cats in this continent.

*Gigantorhynchus moniliformis*, Bremser.

Occurs in *Mus decumanus* and *M. alexandrinus* in Brisbane, but apparently hitherto unrecorded.

*Echinorhynchus menuræ*, n. sp.

(Pl. IV ; Figs. 39, 40).

A single specimen, 19 mm. in length and 1.1 mm. in breadth was taken from the intestine of a lyre-bird, *Menura superba*, near Gosford, N.S. Wales. Owing to the large number of eggs overlying the female organs, very little of the internal anatomy was recognisable.

The parasite has a maggot-like appearance, being somewhat narrower at the anterior end. The body wall is thin and delicate and consequently readily distorted. The small tubular rostellum (Fig. 39) measures about .16 mm. in diameter, and bears about seven whorls of very numerous, narrow, sharp-pointed hooks, each of which projects about .04 mm. beyond the surrounding collar. The proboscis sheath is relatively long.

The only part of the female genitalia recognisable is the lower portion of the uterus, or perhaps more correctly, the vagina, which terminates at the gonopore, the latter lying at the base of a concavity. The elliptical eggs measure .10 by .031 mm., and the embryos .068 by .019 mm.

*Echinorhynchus rotundocapitatus*, n. sp.

(Pl. IV ; Fig. 41).

This species occurs commonly (Johnston, P.L.S., N.S.W., 1909, p. 590 ; P.R.S., Q'land, 1911, p. 238), in the rectum of the black snake, *Pseudechis porphyriacus*, Shaw, in various parts of New South Wales and Victoria.



The females may reach a length of 32 mm., the males being much smaller (12 mm. long). The body is firm and whitish, the cuticle being smooth or crinkled transversely. The proboscis is nearly spherical, measuring .76 mm. across, and bearing about seven spirally-arranged series of hooks, each series consisting of twelve to sixteen hooks, according to their position on the proboscis. The hooks are powerful structures, consisting of a relatively strong basal portion and of a stout backwardly-projecting hook, surrounded at its base by a small collar. The posterior end of the male is slightly narrowed, and bears the male gonopore. The extremity of the female is slightly swollen and bifid, there being two prominent lobes between which lies the genital aperture.

The following account is taken from a male. The proboscis sheath is an elongate sac 1.6 mm. long. The lemmisci are extremely long, extending through the anterior three-fourths of the parasite. The two rounded testes lie just in front of the middle of the worm. Their long diameter is nearly a millimetre. The vasa deferentia unite to form a large swollen convoluted vesicula seminalis, the lower part of which is a sac-like structure succeeded by the ejaculatory duct. The latter terminates at the small bursa which in turn communicates with the exterior through the male gonopore.

The vagina or uterus is long and thin. Eggs measure .087 mm. in length, the embryos being .043 mm. long.

*Echinorhynchus*, sp.

(Pl. II; Figs. 9, 10).

Last year, I found a larval echinorhynch encysted in the peritoneum lining the body wall of a common golden frog, *Hyla aurea*, near Sydney. The length, excluding the rostellum which measures .72 mm. when everted, reaches 1.53 mm. The rostellum bears about twelve whorls of hooks, each whorl consisting of about sixteen. The hooks (Fig. 10) possess a stout basal portion, and of a long sharp claw partly surrounded by a collar-like outgrowth of the rostellar cuticle. The entire hook, when measured from the point to the upper end of the base, reaches a length of .150 mm., of which .115 mm. protrudes. The rostellar sheath is relatively short, the lemmisci being much longer.



No sex organs were recognisable, but the specimen is probably a female. Although a large number of frogs were examined, parasite was found only once. It thus appears to be rare. I refrain from giving a specific name to this larval form.

# LIST OF HOSTS AND THEIR PARASITES, REFERRED TO IN THIS PAPER.

## MAMMALIA :—

*Mus decumanus*  
(*Epimys norvegicus*)

*Hymenolepis diminuta*  
*Cysticercus fasciolaris*  
*Gigantorhynchus moniliformis*  
*Spiroptera obtusa*  
*Heterakis spumosa*  
*Oxyuris obvelata*  
*Trichodes crassicauda*  
*Trichosoma hepaticum*

*Mus rattus (alexandrinus)*

*Hymenolepis diminuta*  
*Cysticercus fasciolaris*  
*Gigantorhynchus moniliformis*  
*Spiroptera obtusa*  
*Heterakis spumosa*  
*Oxyuris obvelata*  
*Trichosoma hepaticum*

*Mus musculus*

*Cysticercus fasciolaris*  
*Spiroptera obtusa*  
*Oxyuris obvelata*  
*Trichosoma hepaticum*

*Canis familiaris*

*Dipylidium caninum*  
*Agchylostoma caninum*  
*Toxocara (Toxascaris) canis*

*Felis domestica*

*Dibothriocephalus felis*  
*Tænia crassicollis*  
*Dipylidium caninum*  
*Agchylostoma caninum*  
*Belascaris mystax*

*Sus scrofa*, dom.

*Stephanurus dentatus*

*Bos taurus*, dom.

*Fasciola hepatica*

*Ovis aries*, dom.

*Fasciola hepatica*

*Dasyurus viverrinus*

*Echinonema cinctum*



<i>Macropus giganteus</i>	<i>Filaria websteri</i>
<i>Macropus dorsalis</i>	<i>F. websteri</i>
<i>Macropus parryi</i>	<i>F. websteri</i>
<i>Onychogale frenata</i>	<i>Cittotænia bancrofti</i> , n. sp.

## AVES :—

<i>Gallus domesticus</i>	<i>Hymenolepis carioca</i>
	<i>Davainea tetragona</i>
	<i>Davainea cesticillus</i>
	<i>Davainea proglottina</i>
	<i>Amæbotænia cuneata</i>
	<i>Heterakis perspicillum</i>
	<i>Heterakis papillosa</i>
<i>Gallopavo meleagris</i>	<i>Metroliasthes lucida</i>
<i>Catheturus lathamii</i>	<i>Heterakis catheturinus</i> , n. sp.
	<i>Heterakis bancrofti</i> , n. sp.
	<i>Echinorhynchus</i> , sp.
<i>Anas superciliosa</i>	<i>Hymenolepis megalops</i>
	<i>Diorchis flavescens</i>
	<i>Echinostoma</i> , sp.
<i>Nettion castaneum</i>	<i>Hymenolepis megalops</i>
<i>Aythya australis</i>	<i>Diploposthe lævis</i>
<i>Chenonetta jubata</i>	<i>Heterakis chenonettæ</i> , n. sp.
<i>Notophox novæhollandiæ</i>	<i>Bancroftiella glandularis</i>
<i>Pelecanus conspicillatus</i>	<i>Ascaris spiculigera</i>
<i>Plotus novæhollandiæ</i>	<i>Microfilaria</i> , sp.
	<i>Ascaris spiculigera</i>
<i>Phalacrocorax sulcirostris</i>	<i>Microfilaria</i> , sp.
	<i>Ascaris spiculigera</i>
<i>Phalacrocorax carbo</i>	<i>Ascaris</i> , sp.
<i>Larus canus</i>	<i>Choanotænia clerici</i> , nom. nov.
<i>Gymnorhina tibicen</i>	<i>Filaria clelandi</i> , n. sp.
<i>Menura superba</i>	<i>Echinorhynchus menuræ</i> , n. sp.
<i>Philemon citreigularis</i>	<i>Filaria</i> , sp.
<i>Acanthogenys rufigularis</i>	<i>Filaria</i> , sp.
<i>Anthochæra carunculata</i>	<i>Oxyspirura anthochæræ</i> , n. sp.



## REPTILIA :—

*Varanus belli**Hæmogregarina varanicola**Acanthotænia tidswelli**Physaloptera varani* ?*Physignathus lesueurii**Filaria physignathi*, n. sp.*Pseudechis porphyriacus**Acanthotænia gallardi**Echinorhynchus rotundocapitatus*, n. sp.*Pseudechis australis**Acanthotænia gallardi**Notechis scutatus**Acanthotænia gallardi**Denisonia superba**Acanthotænia gallardi*

## AMPHIBIA :—

*Hyla aurea**Ophiotænia hylæ*, n. sp.*Sparganum*, sp.*Echinorhynchus*, sp.*Hyla cærulea**Sparganum*, sp.

## PISCES :—

*Neoceratodus forsteri**Amphistoma*, sp.*Amblyonema terdentatum*

## INSECTA :—

*Mastochilus*, sp.*Hystriognathus hystrix**Musca domestica**Habronema muscæ* (larva)*M. vetustissima**H. muscæ* (larva)*Stomoxys calcitrans**H. muscæ* (larva)*Ceratophyllus fasciatus**Hymenolepis diminuta*  
(Cysticercoid)*Hym. murina* (Cysticercoid)*Agamonema* sp. (? larva of  
*Spiroptera obtusa*)*Xenopsylla cheopis**Hymenolepis diminuta*  
(Cysticercoid)*Hym. murina* (Cysticercoid)*Agamonema*, sp. (? larva of  
*Spiroptera obtusa*)

## REFERENCE TO LETTERING.

a., anus ; a.m.p., apical muscle plug ; b., bursa ; c., cirrus ; c.g., cerebral ganglion ; cl., cloaca ; c.s., cirrus sac ; c.w., cyst wall ; cy., cysticercoid ; d.v., dorsal vessel ;



d.v.m., dorso-ventral muscle ; e., egg ; e.d., ejaculatory duct ; e.p., excretory pore ; g.c., genital cloaca ; gl.c., gland cells ; g.p., genital pore ; int., intestine ; l., lip ; lem., lemniscus ; l.l., lateral line ; l.m., longitudinal muscle ; n., nerve ; n.r., nerve ring ; oes., œsophagus ; ov., ovary ; p., p.1., p.2., etc., papillæ ; ph., pharynx ; p.s., proboscis sheath ; r., rostellum ; r.s., receptaculum seminis ; s. sucker ; sh., sheath ; sp., spicule ; t., testis ; tr. m., transverse musculature ; u., uterus ; v., vagina ; v.d., vas deferens ; v.g., vitelline gland ; v.s., vesicula seminalis ; v.v., ventral excretory vessel.

## Plate II.

### *Ophiotænia hylæ.*

- Fig. 1. Scolex.  
2. Segment showing genitalia.

### *Acanthotænia gallardi.*

- Fig. 3. Segment showing genitalia.  
4. Trans. sect. of segment passing through genital ducts.

### *Sparganum*, sp. from *Hyla*.

- Fig. 5. Anterior end.  
6. Posterior end.

### *Filaria clelandi.*

- Fig. 7. Anterior end of a male.  
8. Posterior end of a male.

### *Echinorhynchus*, sp. from *Hyla*.

- Fig. 9. Entire parasite.  
10. Hook from rostellum.

## Plate III.

### *Hymenolepis murina.*

- Fig. 11. Cysticercoids in *Ceratophyllus fasciatus*  
*Agamonema*, sp.

- Fig. 12. Four encysted worms in *Xenopsylla cheopis*.  
13. A parasite enclosed in a cyst.

### *Filaria*, sp. from *Philemon*.

- Fig. 14. Head end.  
15. Tail end.

### *Microfilaria*, sp.

- Fig. 16. From *Plotus novæhollandiæ*.  
17. From *Phalacrocorax sulcirostris*



*Filaria physignatni.*

- Fig. 18. Head end of male.  
 19. Head end of female.  
 20. Portion showing valva.  
 21. Tail end of female.  
 22. Tail end of male.

*Heterakis catheturinus.*

- Fig. 23. Anterior end of female.  
 24. Lips.  
 25. Tail end of male.

## Plate IV.

*Heterakis catheturinus.*

- Fig. 26. Tail end of female.  
 27. Tail end of male.

*Heterakis bancrofti.*

- Fig. 28. Head end of male.  
 29. Lips.  
 30. Tail end of male.

*Heterakis chenonettæ.*

- Fig. 31. Anterior end of female.  
 32. Lip.  
 33. Posterior end of male.

*Oxyspirura anthochæææ.*

- Fig. 34. Head end of male.  
 35. Tail end of male.  
 36. Tail end of female.

*Filaria*, sp. from *Acanthogenys*

- Fig. 37. Anterior end of female.  
 38. Posterior end of female.

*Echinorhynchus menuræ.*

- Fig. 39. Anterior end of female.  
 40. Posterior end of female.

*Echinorhynchus rotundocapitatus.*

- Fig. 41. Entire male worm.

## Plate V.

*Cittotænia bancrofti.*

- Fig. 42. Portion of segment showing one set of genitalia.



- 43. Transv. sect. of segment.
- 44. Longit. horiz. sect. of segment.
- 45. Scolex.

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