

AUSTRALASIAN ANTARCTIC EXPEDITION

1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, O.B.E., B.E., D.Sc., F.R.S.

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SCIENTIFIC REPORTS.

SERIES C.—ZOOLOGY AND BOTANY.

Edited by Professor I. Harvey Johnston,  
University of Adelaide.

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VOL. X PART 5.

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PARASITIC NEMATODA

BY

PROFESSOR T. HARVEY JOHNSTON,  
UNIVERSITY OF ADELAIDE.

WITH TEN TEXT FIGURES.

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PRICE: THREE SHILLINGS AND NINEPENCE.

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## CONTENTS.

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	PAGE.
Introduction ... ..	5
List of Species ... ..	7
Host List and Nematodes identified ... ..	7
<i>Porrocaecum decipiens</i> ... ..	8
<i>Contracaecum osculatum</i> ... ..	12
<i>Contracaecum stenocephalum</i> .. ...	13
<i>Contracaecum radiatum</i> ... ..	14
<i>Contracaecum diomedae</i> ... ..	15
<i>Contracaecum antarcticum</i> , n.sp. ... ..	16
<i>Anisakis similis</i> ... ..	18
Anisakine Larvae from Fish ... ..	19
<i>Paryseria adeliae</i> , n.g., n.sp. ... ..	20
References to Collections of Subantarctic and Antarctic Parasitic Nematodes ... ..	24
Literature ... ..	29

# REPORT ON THE PARASITIC NEMATODES

OF THE

## AUSTRALASIAN ANTARCTIC EXPEDITION.

By T. HARVEY JOHNSTON, Professor of Zoology, University of Adelaide.

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(With ten text-figures.)

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### INTRODUCTION.

The collection of parasitic nematodes obtained by the Australasian Antarctic Expedition during 1912, 1913 and 1914, is represented by comparatively few species, though a great many individuals are present in it. Most of it was taken in the vicinity of Commonwealth Bay, King George V Land, by Dr. J. G. Hunter and the late Dr. A. L. McLean; and nearly all the remainder by Mr. H. Hamilton on Macquarie Island. A few specimens were taken from fish from both of these regions, as well as from Queen Mary Land, by the late E. R. Waite when he was engaged in the study of that collection. The host list includes five species of seals, two birds, and seven kinds of fish. The greater part of the material consists of nematodes from the stomach of Weddell seals. There were twenty-eight separate collections, including the six made by Mr. Waite, distributed amongst hosts as follows:—

- (1) Weddell seal, *Leptonychotes weddelli* Lesson; six collections all made in the vicinity of Cape Denison, Commonwealth Bay, 67° S., 142° 36' E., 26 March, 1912; 1 September, 1912 (two collections); 15 October, 1912; two others taken during 1913, but without mention of the month. Some of these collections had been placed together in the same receptacle.
- (2) Röss seal, *Ommatophoca rossi* Gray; one collection 20 January, 1914. Though not localised on the label, the host was taken by Dr. Hunter in the pack ice near Drygalski Island, off Queen Mary Land.
- (3) Crab-eater, *Lobodon carcinophaga* Hombr. and Jacq.; one collection (? date), Commonwealth Bay.
- (4) Sea leopard, *Hydrurga leptonyx* Blainville; two collections, 28 May, 1912, Macquarie Island; 1913, Commonwealth Bay.
- (5) Sea elephant, *Mirounga leonina* Linn.; five collections; four of them at Macquarie Island, May, 1912, 28 August, 1912, October, 1912, ? month, 1913; the remaining specimens were taken in Commonwealth Bay, 11 January, 1913. The occurrence of this subantarctic species on the Antarctic coast is noteworthy. Dr. Wilson noted a similar occurrence in January, 1904, in McMurdo Strait, 77° 50' S., Ross Sea, during Scott's first expedition ("Discovery").

- (6) Wandering albatross, *Diomedea exulans* Linn.; 12 March, 1913, no locality mentioned, but it must have been obtained by the Expedition's ship, the "Aurora," during its second subantarctic cruise, the chart of the track indicating that the vessel on that date was at 44° 30' S., 141° E., i.e., south-west of Tasmania.
- (7) Adelie penguin, *Pygoscelis adeliae*, Commonwealth Bay, 1913.
- (8) *Notothenia* sp., January, 1913, Commonwealth Bay. The only species of that genus collected in the vicinity of Cape Denison was, according to Waite who reported on the fishes of the expedition, the very common *N. coriiceps* Richardson, so that it is safe to assume that the solitary nematode obtained on that occasion was taken from that species.
- (9) Unnamed fish, probably *N. coriiceps* Richardson and *Trematomus bernacchii* Boulenger, four collections from Commonwealth Bay, 1913.
- (10-14) Waite's material consisted of one or more larval nematodes taken from the peritoneal tissues of each of the following fish. (10) *Trematomus hansonii* Boulenger, off Queen Mary Land (11) *Trematomus scotti* Boulenger, two collections, off Queen Mary Land (12) *Notothenia macrocephala* Gunther (13) *Notothenia coriiceps* var. *macquariensis* Waite; and (14) *Notothenia colbecki* Boulenger. The last three (12-14) came from Macquarie Island.

Ainsworth, in writing of Macquarie Island in Sir Douglas Mawson's "Home of the Blizzard" (Vol. 2, 1915) referred to the finding of "worms," i.e., nematodes, in the stomach of a sea elephant (p. 200) and of a sea leopard (p. 206), as well as in the flesh of various fish (pp. 193, 235).

The material collected by the expedition had been previously studied to some extent by Miss V. Irwin-Smith, who had carried out a good deal of preliminary sorting of the specimens from the Weddell seals in 1918. A considerable number of the parasites had been mounted into balsam and many of them had been identified provisionally. I was able to confirm most of her identifications. Her notes were also made available, but as they referred almost entirely to one species, *Porrocaecum decipiens*, they were not utilised to any extent in my study of the collection.

In her notes, she mentioned that the material was in a poor state of preservation, the cuticle in very many cases having become swollen and detached from the body wall, while the specimens themselves were shrivelled and discoloured and frequently could not be cleared by treatment with any of the numerous clearing reagents used, even after bleaching. She stated that the best results were obtained by carefully graduated treatment with cedar oil, other reagents tried being glycerin, lactophenol, clove oil, xylol-phenol, alcoholic phenol, and oil of bergamot. The original fixing solutions appear to have been either corrosive sublimate or, usually, alcohol. During my own examination of the specimens, the same difficulty in clearing (using lactophenol chiefly) has been encountered and many of the specimens are very dark brown, apparently due in some cases to the tubes and their contents having become dried.

## LIST OF SPECIES.

The following species of parasitic nematodes have been identified as occurring in the collection :—

- (1) *Porrocaecum decipiens* (Krabbe) from Weddell seals and *Mirounga leonina* (Antarctic); sea leopard (Macquarie Island).
- (2) *Porrocaecum* sp. (larva) from Antarctic fish, probably *Notothenia coriiceps* and *Trematomus bernacchii*.
- (3) *Contracaecum osculatum* (Rud) from Weddell seals and Ross seal (Antarctic); sea elephant (Macquarie Island); and sea leopard (Antarctic and Macquarie Island).
- (4) *Contracaecum stenocephalum* (Railliet and Henry) from Weddell seals and sea leopard (Antarctic).
- (5) *Contracaecum radiatum* (Linstow) from Weddell seals and the crab-eater (Antarctic).
- (6) *Contracaecum* (or *Phocascaris*) *diomedae* (Linstow) from *Diomedea exulans* (Southern Ocean, south-west of Tasmania).
- (7) *Contracaecum antarcticum* n. sp. from the Adelie penguin (Antarctic).
- (8) *Contracaecum* sp.—larval form from *Notothenia coriiceps*; *Trematomus bernacchii*; *Trematomus scotti*; *Trematomus hansonii* (Antarctic).
- (9) *Anisakis similis* (Baird) from *Mirounga leonina* (Macquarie Island and Antarctic); sea leopard (Macquarie Island).
- (10) *Anisakis* sp. (larva) from *Notothenia macrocephala*; *Notothenia colbecki*; and *Notothenia coriiceps* var. *macquariensis* (Macquarie Island).
- (11) *Paryseria adeliae* n. sp. from the Adelie penguin (Antarctic).

## HOST LIST AND NEMATODES IDENTIFIED FROM THEM.

- (1) *Leptonychotes weddelli* Lesson, Commonwealth Bay: *Porrocaecum decipiens* (Krabbe); *Contracaecum osculatum* (Rud); *C. stenocephalum* (Railliet and Henry); *C. radiatum* (Linstow).
- (2) *Ommatophoca rossi* Gray, off Queen Mary Land: *Contracaecum radiatum* (Linstow).
- (3) *Lobodon carcinophaga* Hombr. and Jacq., Commonwealth Bay: *Contracaecum radiatum* (Linstow).
- (4) *Hydrurga leptonyx* Blainville, Commonwealth Bay: *Contracaecum osculatum* (Rud.); *C. stenocephalum* (Railliet and Henry). Macquarie Island: *Porrocaecum decipiens* (Krabbe); *Anisakis similis* (Baird).

- (5) *Mirounga leonina* Linn., Macquarie Island: *Porrocaecum decipiens* (Krabbe); *Contraecacum osculatum* (Rud). *Anisakis similis* (Baird). Commonwealth Bay: *Porrocaecum decipiens* (Krabbe); *Anisakis similis* (Baird).
- (6) *Diomedea exulans* Linn., Southern Ocean, south-west of Tasmania: *Contraecacum* (or *Phocascaris*) *diomedeeae* (Linstow).
- (7) *Pygoscelis adeliae* Hombr. and Jacq., Commonwealth Bay: *Paryseria adeliae* n. sp.; *Contraecacum antarcticum* n. sp.
- (8) *Notothenia coriiceps* Richardson, Commonwealth Bay: *Contraecacum* sp. (larva); *Porrocaecum* sp. (larva).
- (9) *Notothenia coriiceps* var. *macquariensis* Waite, Macquarie Island: *Anisakis* sp. (larva).
- (10) *Notothenia colbecki* Boulenger, Macquarie Island: *Anisakis* sp. (larva).
- (11) *Notothenia macrocephala* Gunther, Macquarie Island: *Anisakis* sp. (larva).
- (12) *Trematomus bernacchii* Boulenger, Commonwealth Bay: *Contraecacum* sp. (larva); *Porrocaecum* sp. (larva).
- (13) *Trematomus hansonii* Boulenger, off Queen Mary Land: *Contraecacum* sp. (larva).
- (14) *Trematomus scotti* Boulenger, off Queen Mary Land: *Contraecacum* sp. (larva).

The collection of parasites, including types of the new species, is deposited in the Australian Museum, Sydney.

#### PORROCAECUM DECIPIENS (Krabbe) Baylis.

*Synonymy*—*Ascaris decipiens* Krabbe 1878, 45-47, fig. 1, pl. 1, fig. 3; Jagerskiold 1894, 467-74, figs. 14, 26, 40, 41; Stiles and Hassall 1899, 109-120, figs. 1-22; Stossich 1896, 20; Railliet and Henry 1907, 2-3; Baylis 1916, 365-68, pl. 14, fig. 4; pl. 15, fig. 1; pl. 16, figs. 3, 4; pl. 17, fig. 2.

*Ascaris bulbosa* Cobb 1888—probable synonym according to Jagerskiold 1894, 474; and Stiles and Hassall 1899, 109, 111.

*Ascaris simplex* Linstow 1888, 2-3, pl. 1, fig. 4 (from *Otaria jubata*) nec Rudolphi 1804, according to Baylis 1916, 365.

*Ascaris osculata* Leidy 1891, and Stiles and Hassall 1894, 340 (from *Macrorhinus angustirostris*)—nec Rudolphi, according to Stiles and Hassall 1899, 109, 112.

*Ascaris rectangula* Linstow 1907, 464-8, figs. 1-3, 8-15; nec *Kathleena rectangula* Leiper and Atkinson 1914; 1915 nec *Contraecacum rectangulum* Baylis 1920; 1929; Yorke and Maplestone 1926.

*Physaloptera guarti* Garin 1913, 79-81, 87-88, figs. 27, 30; Ortlepp 1922, 1092.

*Porrocaecum decipiens* Baylis 1920, 261; 1929, 545-6.



Adults of this species were found in small numbers in each of the six collections from the Weddell seal. Many immature specimens apparently referable to it were also present. Very large and some small worms were recognised from material taken from sea leopards (a new host for the parasite) on Macquarie Island. Adult and immature specimens were found, along with *Anisakis similis* in a sea elephant taken in Commonwealth Bay in January, 1913.

The length of the adult male ranged from 26 to 36 mm., with a maximum breadth of 0.88 to 1.4 mm. The cervical papillae were from 0.67 to 0.8 mm. from the anterior end. The anus was distant 0.17 to 0.27 mm. from the posterior end, the difference in distance being related to the difference in size of the various worms measured. The lips were from 0.144 to 0.170 mm. broad at the base and 0.13 to 0.176 mm. long. The number of preanal papillae seemed to vary between 30 and 50 pairs, the post-anal and caudal together usually numbering 5 pairs. The spicules were about 2 mm. long.

Adult females varied between 29 and 55 mm. (usually 40 to 50) in length by 1.2 to 2 mm. (usually 1.5) in maximum breadth. The cervical papillae were distant 0.64 to 0.75 mm. from the anterior end, and the anus 0.13 to 0.45 mm. from the posterior extremity. The vulva lay just behind the first third of the body length—two-fifths to three-sevenths from the anterior end.

The intestinal caecum in the adult male varied in length between 0.8 and 1.3 mm.; the glandular part of the oesophagus between 0.72 and 0.96, and the muscular portion between 2.1 and 2.4 mm.; while in the case of the female these dimensions were slightly exceeded.

*Porrocaecum decipiens* has been recorded and described from many species of northern seals by Krabbe (1878), Jagerskiold (1894), Stiles and Hassall (1899), Linstow (1905) and Baylis (1916). Leidy (1891), as well as Stiles and Hassall (1894, 340), recorded it under the name of *Ascaris osculata* from the northern sea elephant, *Macrorhinus angustirostris*, but later (Stiles and Hassall 1899, 109, 112) it was identified as *A. decipiens*. These authors also gave a well-illustrated description (1899) of the parasite from Alaskan seals and reproduced accounts and figures from earlier workers. The first record of the nematode as a southern species was that of Railliet and Henry (1907) who reported it from Weddell and Ross seals taken by the First French Antarctic Expedition, other ascarids being present in each case.

In his report on the entozoa collected by the "Challenger," Linstow (1888) gave an account of a parasite, regarded by him as *Ascaris simplex* Rud., taken from *Otaria jubata* (a misdetermination for *Arctocephalus gazella*, as indicated later in this report) from Kerguelen. Baylis (1916) re-examined this material and found it to be *A. decipiens*, *A. simplex* being restricted, as far as known, to cetaceans. This author also reported that *A. decipiens*, on account of the absence of interlabia and of an oesophageal appendage and the presence of an intestinal caecum, belonged to the same group of ascarids as that for which Leiper and Atkinson (1914, 1915) had erected the genus *Terranova*. Baylis

(1920, 259) subsequently listed this genus as a synonym of *Porrocaecum* Railliet and Henry, and placed *Asc. decipiens* under the latter. He (1916) also discussed the probability of *Ascaris capsularia* Rud., a larval parasite commonly occurring under the peritoneal lining of the digestive tract of marine fishes, being the young stage of *P. decipiens*.

Amongst the nematodes taken from the Weddell seal at the South Orkneys by the "Scotia," Linstow (1907, 464-8 and figs.) found two species, which he regarded as new, the larger being described as *Ascaris rectangula*, Leiper and Atkinson (1914, 1915) transferring it to *Contraecum*, where Baylis (1920, 1929) as well as Yorke and Maplestone (1926) also placed it. If one compares Linstow's account with those of *P. decipiens*, as given by Stiles and Hassall (1898) and by Baylis (1916) especially, one must conclude that *A. rectangula* is a synonym of the latter, the only point of disagreement being the reported absence of dentigerous ridges in the former. The two agree broadly in the following features—dimensions, anterior end narrower than the posterior, small lips without interlabia, characteristic form of the processes arising from the lips, presence of intestinal caecum, no oesophageal caecum (Linstow's unpaired gland, p. 465 and fig. 3, is apparently the excretory cell, though some of his remarks in the description may be taken to refer to a glandular caecum), length of spicules, position of vulva in relation to body length, and form of female tail. There are some differences in connection with the posterior end of the male. The alae are narrower in *A. rectangula* than in the figures of *A. decipiens* given by Stiles and Hassall and by Baylis, but they resemble those in Krabbe's illustration. In the material examined by us from Weddell seals, they appeared rather narrow. The general disposition of the post-anal papillae agrees fairly well in the two cases. Linstow mentioned (1907, 468) that a similar group of ascarids occurred in northern seals where it was represented by *A. decipiens*.

Linstow (1907) also gave an account of various developmental stages found in Weddell seals and figured some of them. The intermediate host was stated to be a common fish, probably a *Trematomus* or a *Notothenia*, the larvae reaching a length of 39 mm. by 1.30 mm. All stages from larvae 3.7 mm. long by 0.23 mm. broad, to the adult condition were met with in the stomach of the seal. The figures (figs. 12, 13) of the anterior part of the digestive tract of a late larva, presumably from the final host, agree closely with those given by Baylis (1916, pl. 14, figs. 3 and 4) for a 38 mm. larva of *Ascaris capsularia*, and for an adult of *P. decipiens*. Linstow (p. 466) found an intestinal caecum, and apparently also an oesophageal caecum, in larvae only 3.7 mm. long, as well as in those 10 mm. and 20 mm. in length, the oesophageal process being relatively shorter with increasing age of the larva, while in the largest larvae the oesophageal process had disappeared. It seems to me that Linstow must have confused at least two different types of larvae, or rather, juvenile, forms. The largest probably belonged to *P. decipiens*, while many of the others, no doubt, belonged to one or other of the several species of *Contraecum* which occur in the same host, the smaller forms being probably *C. radiatum* of which he reported finding specimens only 6.72 mm. long by 0.40 mm. broad in the seal's stomach.

Leiper and Atkinson (1914, 1915) were probably misled by the similarity in size and in the general arrangement of the male papillae and alae to conclude that Linstow's species and *Ascaris stenocephala* Railliet and Henry, were synonymous and belonged to *Kathleena*, i.e., to *Contracaecum*. Such a generic assignment is incorrect because of the arrangement of the lips and of the caeca. Baylis (1920) as well as Yorke and Maplestone (1926) have probably followed Leiper and Atkinson.

I think it quite likely that Linstow had before him amongst his "Scotia" material *C. stenocephalum* also, but there is nothing in his account, except perhaps part of the figure of the male, to indicate it.

Garin, who examined some material consisting of portion of the stomach of a Weddell seal with nematodes firmly attached, collected by the Belgian Antarctic Expedition, described as a new species, *Physaloptera guarti* (1913, 79-81, fig. 27), a single large worm found amongst numbers of the much smaller *Ascaris falcigera*, i.e., *Contracaecum radiatum*. He also gave an account of the pathology of the lesion caused (p. 828, fig. 30). The parasite was a male, 35 mm. long by 2 mm. wide. Its anterior end, as studied in a longitudinal section in situ in the mucosa, was stated to possess chitinous expansions, while the mouth was apparently not provided with teeth. The posterior end which had been removed prior to sectioning, the remainder, was described as recurved, with a caudal bursa with a festooned border, while around the anus were grouped four pairs of stalked papillae, but no inner papillae. An examination of the figure of his section shows the presence of three lips whose total width was more or less the same as that of the body; the cuticle was obviously detached in part from the anterior end so that the wing-like expansions may have been exaggerated somewhat. The head is that of an Ascaridate nematode. The bursa is not typical of a *Physaloptera* and the figure seems to be very diagrammatic. Enough is shown to allow one to compare the tail with the tip of the tail of Linstow's *Ascaris rectangula*. Assuming the anus to be incorrectly placed, one would be justified in stating that Garin was dealing with an Ascaridate, almost certainly *Porrocaecum decipiens*, with which his *Phys. guarti* agrees in dimensions and in the other features mentioned. *Contracaecum stenocephalum* is not likely to be the same species, since the breadth of the lip region in relation to the rest of the body, and the slight cuticular expansions behind the head, together with the absence of the well-marked cuticular folds just behind the lips in Garin's specimen, support the view regarding synonymy already put forward. Ortlepp (1923, 1092) mentioned that Garin's crude drawing indicated a *Physaloptera*, but that the absence of teeth and of internal papillae was very remarkable.

Gedoelst (1916, 20), in his key to the genera and some species of Heterocheilinae, retained *Porrocaecum decipiens* under *Ascaris*, placing it, in error, amongst those possessing both intestinal and oesophageal caeca. Stiles and Hassall (1899, figs. 5, 16), and Jagerskiold (1894, pl. 28, fig. 40) indicated that an oesophageal caecum might occur in the species, but perhaps these figures may relate to some other parasite.

## CONTRACAECUM OSCULATUM (Rud.) Baylis.

*Synonymy*—*Ascaris osculata* Rudolphi 1802; Schneider 1866, 44, pl. 1, fig. 13; Krabbe 1878, 45, pl. 1, fig. 1; Linstow 1892, 8-9, pl. 2, fig. 11-16; 1907, 469-70, pl. 26, fig. 7; Jagerskiold 1894, 457-463, figs. 12, 35, 36, 38; Stossich 1896, 37-8; Stiles and Hassall 1899, 151-9, figs. 76-92; Railliet and Henry 1907, 3-4; Ariola 1914, 68-70.

*Kathleena osculata* Leiper and Atkinson 1914, 226; 1915, 27.

*Contracaecum osculatum* Baylis 1920, 262.

This species occurred in most of the collections obtained from Weddell seals; also in the only collection from the Ross seal, as well as in two from the sea leopard, viz., from Commonwealth Bay and from Macquarie Island. An immature individual was found amongst numerous *Anisakis similis* from a sea elephant from the latter locality.

The first record from the Antarctic of this common parasite of northern seals\* was made by Linstow (1892) from material collected from the sea leopard in South Georgia. His figures and an abstract of his account were reproduced by Stiles and Hassall (1899, 156, figs. 79-82) who published additional figures relating to material from an Alaskan seal. Linstow (1896, 14) in his list of subantarctic parasitic nematodes, mentioned this species and stated that its hosts were *Otaria jubata*, *Stenorhynchus leptonyx* and *Cystophora proboscidea*, i.e., the South American sea lion, the sea leopard and the sea elephant respectively, but I am not aware of his authority for including the first and third of these. In his report on the "Scotia" collection (1907) he recognised it from the Weddell seal from the South Orkneys, all the other hosts mentioned by him being northern seals. Railliet and Henry (1907) reported its occurrence in the Weddell seal as well as in the crab-eater from Graham Land region (First French Antarctic Expedition). The "Terra Nova" obtained a goodly number of immature forms from the sea leopard and the crab-eater, as well as larvae, probably belonging to *C. osculata*, from the mesentery and subperitoneal tissues of the pyloric caeca and liver of a common Antarctic fish, *Trematomus bernacchii*, all of this material having been obtained from the Ross Sea.

Leidy (1891), as well as Stiles and Hassall (1894), had reported its presence in the sea elephant, *Macrorhinus angustirostris*, which occurs on the Pacific coast of North America. A little later, the latter authors identified the worms as *Porrocaecum decipiens*. Ariola (1914) listed amongst the many known hosts of *C. osculata*, *Foca elephantina*, *Macrorhinus leoninus* and *Ogmorhinus leptonyx*. The last was no doubt based on Linstow's record from the sea leopard, while the other two names belong to the same animal. As Ariola's paper (1914) is known to me only by its title, I am not aware of the locality of his material. *Macrorhinus angustirostris*, from which Leidy's specimens were obtained, is, according to some authors, only a northern race of the typical southern

\* In this paper Linstow mentioned ten northern pinnipeds as hosts. In 1895 (Arch. f. mikr. Anat., 44, 1895, 528-31, p. 31, figs. 1-14) he gave an account of its anatomy, nine Arctic species and one Antarctic (the sea leopard) being named as hosts.

sea elephant, *Mirounga leonina*. It might be mentioned that Linstow in 1907 gave only one southern host, the Weddell seal, while among the many northern seals listed, there was mentioned *Cystophora cristata*. Stiles and Hassall's record (1899, 152) of the parasite from *Otaria jubata*, the sea lion of South America, is founded on a manuscript catalogue by Parona, whose entry may perhaps relate to Linstow's statement (1896).

Railliet and Henry (1907, 6) believed that Linstow (1892) had confused *Ascaris osculata* with *A. falcigera*, and that the figure of the male published by him really belonged to the latter species. Some of Linstow's original material from a sea leopard from South Georgia was re-examined by the French authors and found to be *C. osculatum*, hence they considered it likely that both species were present amongst the specimens collected on that occasion. Railliet and Henry's opinion appears to be correct.

*CONTRACAECUM STENOCEPHALUM* (Railliet and Henry) Yorke and Maplestone.

*Synonymy*—*Ascaris stenocephala* Railliet and Henry 1907, 7-10, text fig. 3, pl. 1, figs. 8-12.

*Ascaris rectangula*, of Leiper and Atkinson 1914, 1915; nec Linstow 1907.

*Kathleena rectangula* Leiper and Atkinson 1914, 226; 1915, 27-8.

*Contracecum rectangulum*, Baylis 1920, 262; 1929, 547; Yorke and Maplestone 1926, 282.

*Contracecum stenocephalum* Yorke and Maplestone 1926, 282.

This species of nematode was collected from the stomach of two Weddell seals in company with *Porrocaecum decipiens*, *Contracecum radiatum* and *C. osculatum*. A number of immature specimens were found in a sea leopard, also from Commonwealth Bay.

Railliet and Henry (1907) first identified it from several Weddell seals and from a sea leopard from Graham Land. They referred to the difficulty experienced in separating that species from their *Ascaris falcigera* (i.e., *C. radiatum*) owing to the similarity of most of the anatomical features, other than the lips, but the difference in size between the two species at maturity is usually fairly well marked. These authors mentioned that the lateral portions of the male tail were somewhat vesicular rather than alate, and Linstow's figure of the termination of the male of his *Ascaris rectangula* shows a similar appearance, so that it is likely that Linstow had to some extent confused *P. decipiens* (Syn. *Asc. rectangula*) and *C. stenocephalum*.

Leiper and Atkinson (1914; 1915) referred to this species as *Kathleena rectangula* from the Weddell seal, but as their material possessed interlabia, oesophageal

diverticulum and intestinal caecum, they were not dealing with Linstow's species, of which they regarded Railliet and Henry's as a synonym. The assignment to *Contra-caecum* suggests that Baylis (1920; 1929) accepted Leiper and Atkinson's synonymy.

Baylis (1929, 547) recorded *C. rectangulum* from the stomach of sea leopards (South Sandwich Group and Palmer Group), and stated that immature forms probably belonging to the same species were found in a crab-eater (Palmer Group). The localities are in the vicinity of the region (Graham Land) explored by the French Antarctic Expedition.

CONTRACAECUM RADIATUM (*Linstow*) *Baylis*.

*Synonymy*—*Ascaris radiata* Linstow 1907, 468-9, figs. 4-5.

*Ascaris falcigera* Railliet and Henry 1907, 4-7, text figs. 1-2, pl. 1, figs. 1-7.

*Ascaris falcigera* Garin 1913, 36-41, figs. 6-7.

*Kathleena radiata* Leiper and Atkinson 1915, 26-7, fig. 2.

*Ascaris osculata* of Linstow 1892, fig. 16, nec Rudolphi.

*Contracaecum radiatum* Baylis 1920, 262; Yorke and Maplestone 1926, 282.

*Contracaecum falcigerum* Baylis 1920, 262; Yorke and Maplestone 1926, 282.

This, the smallest of the species infesting the Weddell seal, occurred in all collections from this host, usually in considerable numbers. Several specimens, nearly all of them with a prominent larval tooth, were taken from a crab-eater. The species has been collected from the Weddell seal by the "Scotia" (Linstow); "Belgica" (Garin); "Français" (Railliet and Henry); and the "Terra Nova" (Leiper and Atkinson). The "Français" obtained it also from a Ross seal. Railliet and Henry (1907, 7) regarded Linstow's figure (1892, fig. 16) of the male tail of a specimen, determined by him as *Ascaris osculata* and taken from a sea leopard from South Georgia, as belonging to *Asc. falcigera*, and a comparison of the two figures confirms the correctness of the view.

The close resemblance between this form and *C. stenocephalum* has been noted above. The best description is that of Railliet and Henry. The various accounts show considerable discrepancies in regard to size. Though there are a few minor differences, apart from dimensions, between the descriptions of Linstow's *radiata* and of Railliet and Henry's *falcigera*, there is little doubt as to the identity of the forms. Linstow's figure of the intermediate lips differs somewhat from that of the French authors, who, moreover, indicate that the papillae of the main lips are double. The characters of the lips and their size as a group, relative to the succeeding region of the body, afford the most ready method of differentiating the species from others occurring in southern seals.

CONTRACAECUM DIOMEDEAE (*Linstow*) *Johnston*.

*Synonymy*—*Ascaris diomedae* Linstow 1888, 6, pl. 1, figs. 12-13; 1907, 470. Stossich 1896, 18.

*Anisakis diomedae* Yorke and Maplestone 1926, 272.

This species is represented by four immature specimens taken from the stomach of a wandering albatross, *Diomedea exulans*, on 12th March, 1913. No locality was mentioned. As stated earlier, the parasites must have been taken by the "Aurora" during one of the sub-antarctic cruises, the ship on that date being in the vicinity of 44° 30' S., 141° E., to the south-west of Tasmania. The largest measured about 60 by 2.5 mm., while others were much smaller and narrower, being from 27 to 36 mm. long by about a millimetre in breadth.

The characters agree in all essentials with those given by Linstow (1888, 6), whose material was taken by the "Challenger" in June, 1875, in the North Pacific. The host is quoted as *Diomedea brachyura* (i.e., *D. albatrus*), but Godman, in his monograph of the albatrosses and petrels, stated that *D. brachyura* of the "Challenger" reports was really *D. nigripes*, consequently it is under the latter species that the nematode should be listed.

It was also recorded by Linstow (1907, 470) as having been collected by the "Scotia" from the mouth cavity of *Diomedea* sp., "Loof's Albatross," no locality being mentioned, though the South Orkneys are most probable, as the ship wintered there. I cannot trace any such bird as "Loof's" albatross, and consider it most likely that the name is an error for the "sooty" albatross, *Phoebastria palpebrata*, which frequents the neighbouring seas and breeds on the islands, the species being referred to in the reports on the "Scotia" birds. This material was also immature, though the dimensions were 41 mm. in length by 0.72 mm. in breadth.

The "Aurora" specimens show the various lip characters described by Linstow, presence of tooth plates, absence of intermediate lips, presence of prominent cervical papillae, the very marked bending of the posterior region of the oesophagus to make a right angle with the intestine and the anterior oesophagus, the presence of oesophageal and intestinal caeca, and the very short, rounded tail.

The only other Ascaridate nematode recorded from southern albatrosses is *Contraecum scotti* (Leiper and Atkinson 1914, 226; 1915, 24-26), originally described as *Kathleena scotti*, and collected from *Diomedea melanophrys* by the "Terra Nova" in 52° 20' S., 167° 30' E., off Campbell Island. This species, when mature, is much smaller than *C. diomedae*, besides possessing definite intermediate lips and a fingerlike tail process. It is a typical member of the genus *Contraecum*.

*Ascaris arctica* was described by Linstow (1880, 42) from *Diomedea leucops*\* from the North Pacific (northern ice-sea). The lips in that species have a dentigerous ridge, and since there is no mention of interlabia, one may assume that they are absent. No reference is made to the presence of intestinal or oesophageal caeca. The parasite is a member of the Anisakinae, and can be placed under *Anisakis arctica* until more fully described. Neither *A. arctica* nor *C. diomedae* was referred to by Cram (1927) in her monograph of several groups of nematodes from birds.

*C. diomedae* is not quite typical of *Contracaecum* because of the presence of tooth plates and the absence of intermediate lips. Host (1932, 339) recently erected *Phocascaris* for a species from a northern seal, differing from *Contracaecum* in the characters referred to. If this genus be valid, as I think it is, then Linstow's species should be known as *Phocascaris diomedae*. The presence of caeca excludes the species from *Anisakis*, where Yorke and Maplestone (1926) had placed it.

CONTRACAECUM ANTARCTICUM n. sp. (figs. 1-4).

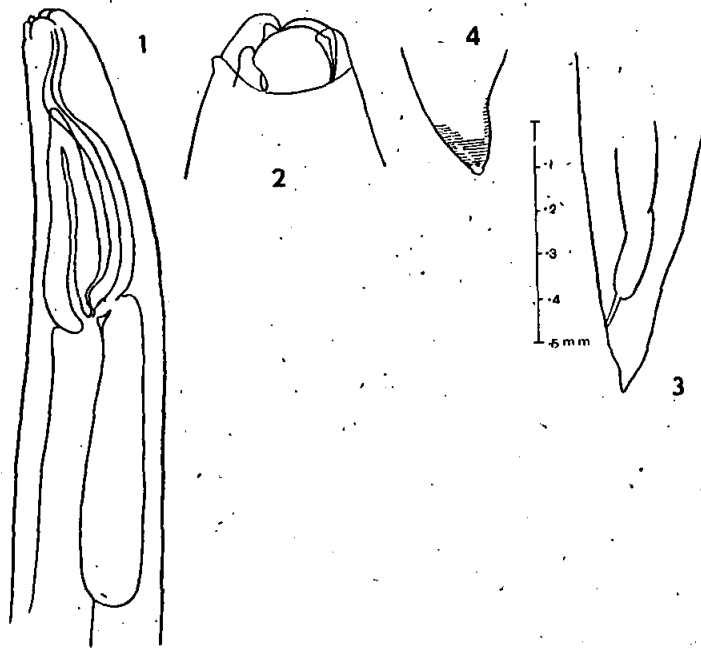
Several specimens of a small *Contracaecum*, together with two worms described in this report as *Paryseria adeliae*, were taken from the stomach of an Adelie penguin in Commonwealth Bay. The parasites were immature, and it is with considerable hesitation that a specific name has been attached to them. The rarity of occurrence of nematodes in penguins and the fact that opportunity is seldom afforded to examine this antarctic species for parasites, have been the deciding factors. The head end of most specimens was embedded in some kind of material, from which it was separated with difficulty. The species is probably a parasite of the penguin, as the worms were not undergoing any disintegration when collected. The smallest specimen measures 7 mm. by 0.4 mm. in maximum breadth, while the largest is 11 mm. by 0.52 mm. The worms are attenuated slightly towards each extremity, especially the posterior, which terminates in a short conical tail, moderately broad and ending in a very small rounded knob. The anterior end is rounded, except for the low truncate lips. The breadth of the lip region is 0.08 to 0.11 mm.; that of the head 0.20 mm. at 0.1 mm. behind the lips, and 0.33 mm. at 1 mm. from the anterior end, the breadth gradually increasing from this region. The width at the level of the anus, which is 0.19 mm. from the tip, is 0.13 mm. The annulations are relatively inconspicuous in most specimens. There is no neck constriction. The lips are very low, the dorsal being slightly less prominent. The height of the dorsal is about 0.04 to 0.5 mm. and the width, including the small labial processes, 0.06 mm. Its anterior end is somewhat rounded and projects at each corner where there appears to be

\*I have been unable to trace *Diomedea leucops* in any of the works available. It is not mentioned in Godman's Monograph; nor in various hand lists of birds. Linstow did not quote an author's name in his original account of *Ascaris arctica*, nor in his Compendium der Helminthologie, Nachtrag, 1888. The specific name, *leucops*, suggests that the bird may have been *D. nigripes*, a dark bird with a striking white area around the eyes, this species of albatross ranging from Bering Sea to the tropics (North Pacific).



a papilla in the vicinity. Closely adjacent to one of the ventral lips is a prominent conical tooth, suggestive of that present in larval forms. The interlabia were seen in very few specimens, and appear as narrow curved structures about the same height as the ventral lips. The dorsal is wider than the latter. The cuticular covering of the lips is very thin except in the vicinity of the lateral projections of the dorsal, where it is slightly thickened.

The oesophagus is about 0.05 mm. wide, and usually has a more or less markedly curved course, measuring about 0.65 mm. It gives off a large appendix 0.7 mm. long by



*Contracaecum antarcticum.*

Fig. 1.—Anterior portion. Fig. 2.—Lip region. Fig. 3.—Tail.  
Fig. 4.—Extremity of tail.

0.1–0.15 mm. wide. The intestine has a wide caecum about 0.5 mm. long extending forwards to the region of the nerve ring. The tail gland cells are prominent, and lie in the vicinity of the anus.

In the absence of mature material it is impossible to compare satisfactorily this form with that of other avian species. The character of the dorsal lip, though not well defined, does not agree with that of others. The narrow tail, relatively large oesophageal appendix and caecum (especially when compared with the oesophageal length), and the absence of neck constriction, should serve to differentiate the species from all those listed by Cram (1927).

ANISAKIS SIMILIS (*Baird*) *Baylis*.

*Synonymy*—*Ascaris similis* Baird 1853 *a*, 19, pl. 1, fig. 1; 1853 *b*, 18; 1855, 69–70; Stossich 1896, 69; Stiles and Hassall 1899, 146–7; Baylis 1916, 370–2, pl. 15, fig. 2, pl. 17, fig. 1.

*Anisakis similis* Baylis 1920, 260; 1929, 543.

*Ascaris patagonica* Linstow 1880, 41–2, pl. 3, fig. 1; Stiles and Hassall 1899, 143–44.

*Anisakis patagonica* Yorke and Maplestone 1926, 273.

This rather large species was found commonly in the sea elephant, being present in all the collections taken from that host on Macquarie Island and, except for a solitary specimen of *Contracaecum osculatum*, it was the only species of nematode represented amongst them. In one case a portion of the stomach was preserved, its surface being thickly covered with the worms whose heads were buried in the mucosa. It was obtained from the same host species, along with *Porrocaecum decipiens*, from Commonwealth Bay (January, 1913). These two species of nematodes were also present in a sea leopard from Macquarie Island (May, 1912)—this seal being an addition to the known host-list of *A. similis*.

The species was first described from specimens brought back from an unidentified seal by an Antarctic Expedition, the available evidence indicating that commanded by Sir James Clark Ross ("Erebus" and "Terror"). Diesing and Stossich recorded the host as *Phoca* sp. Baylis (1916) re-examined Baird's material in the British Museum and gave a detailed account of it, showing that it was a distinct species and not a synonym of *Porrocaecum decipiens* as Stiles and Hassall (1899, 146) had suggested. Baylis (1920) allotted it to *Anisakis* and in 1929 recognised it in specimens taken from a sea elephant in South Georgia.

The species is at first sight rather like *P. decipiens*, being similar in size, wider posteriorly than anteriorly (though less so than in the latter species), and with a rounded end in the female. It differs, however, in lacking cuticular expansions along the region behind the head, in having a more club-like posterior end in the females, and in possessing usually a very small narrow projecting spine-like tail, though Baylis (1916, 372) reported that the tip of the tail was slightly indented and that the terminal spike was absent in Baird's material. The difference in the structure of the lips and of the digestive tract has been referred to by Baylis.

As it seems to be common in the sea elephant, *Mirounga leonina* may have been the original host, since Ross obtained specimens of it from "the Southern Ocean," Gray (Mammals, Voyage of the "Erebus" and "Terror," 1), Gray (Brit. Museum Cat. Seals and Whales 1866, 40) subsequently giving the locality as "Antarctic Seas."

*Ascaris patagonica* Linstow (1880, 41) from *Otaria jubata* from Patagonia agrees with Baird's species in dimensions, character of the lips (except for the presence of a double dentigerous ridge in the former), form of the tail in both sexes, abundance of closely

arranged papillae on the male, and possession of circular eggs of approximately similar diameter. There is no information available regarding the characters of the digestive tract, though Yorke and Maplestone (1926) placed the species under *Anisakis*. There seems to be little doubt that Linstow's species is a synonym of *Anisakis similis*. The host list is now known to include the sea elephant, sea leopard and *Otaria jubata*, and the species is now known to range from Patagonia and South Georgia to Macquarie Island.

It is possible that the *Anisakis* larvae recorded in this paper as occurring in fish, *Notothenia* spp., from Macquarie Island may be, in part, the young stage of *A. similis*. It should be mentioned, however, that cephalopods seem to form the main article of diet of the sea elephant if we can base a conclusion on the stomach contents of animals during their period ashore. The horny beaks of cuttle-fish resist digestion, whereas bony structures such as those from fish would soon be dissolved. *Otaria jubata* and *Hydrurga leptonyx* feed largely on fish, though the latter utilises other marine vertebrates as well.

#### ANISAKINE LARVAE.

Larvae belonging to the Anisakinae were found in several fish. They were of three types. The one was slender, devoid of oesophageal intestinal caeca, and occurring in round flat capsules within which the parasite was spirally coiled and surrounded by its shed cuticles. It occurred especially in the vicinity of the attachment of the mesentery to the digestive tract. The second was larger, thicker, and possessed an intestinal caecum. The third type was not so markedly coiled and was provided with a caecum as well as an oesophageal appendix. The first is recorded as *Anisakis* sp., though as Baylis (1916, 364) has pointed out, in some species and perhaps in this one, an intestinal caecum may develop later in larval life, such larvae belonging to *Porrocaecum*, to which our second kind of parasite can be assigned. The third is listed as *Contracecum* sp., no attempt being made to determine the possible relationship with any adult forms, though they are probably parasitic in southern seals and, in the case of *Contracecum* spp., in subantarctic cormorants as well.

#### *Anisakis* sp. (larva).

From *Notothenia macrocephala*; *Notothenia coriiceps* var. *macquariensis*; *Notothenia colbecki*; all from Macquarie Island and taken by Waite from fish belonging to the expedition.

#### *Porrocaecum* sp. (larva).

These possess a tail region like that described for *P. decipiens* and are probably its larva, i.e., "*Ascaris capsularia*." From three different collections of unnamed *Nototheniid* fish, taken by Dr. McLean in Commonwealth Bay in 1913.

*Contracaecum* sp. (larva).

There was a stouter form represented by a specimen 22 mm. long by 0.8 mm. wide, resembling *C. osculatum* in some ways, but its short blunt tail with the anus at 0.19 mm. from the tip, was more like that of *P. decipiens*. There was a large oesophageal appendix and a long intestinal caecum. It occurred in a *Notothenia* (presumably *N. coriiceps*) from Commonwealth Bay.

There were smaller forms, all of them rather broad and somewhat twisted (rather than coiled) in elongate cysts. These were obtained from two unnamed Nototheniid fish from Commonwealth Bay.

A solitary specimen was taken from the intestinal wall (probably subperitoneal) of each of two specimens of *Trematomus scotti*, off the Shackleton Ice Shelf, Queen Mary Land, in 110 fathoms; and a very young form from *Trematomus hansonii*, in 250 fathoms, also off Queen Mary Land, 66° 28' S., 92° 42' E. These specimens were obtained by E. R. Waite in 1916 during his examination of the fish collection.

Waite stated that the only fishes brought back from shallow water (2½ to 5 fathoms) in Commonwealth Bay, were *Trematomus bernacchii* and *Notothenia coriiceps*—two closely related fish. The former was also taken in deeper waters in the Bay by the "Aurora." The fish from which McLean collected the parasites must have been one, or (more probably) both, of these species, as they have similar habits and both form the main part of the diet of the local Weddell seals.

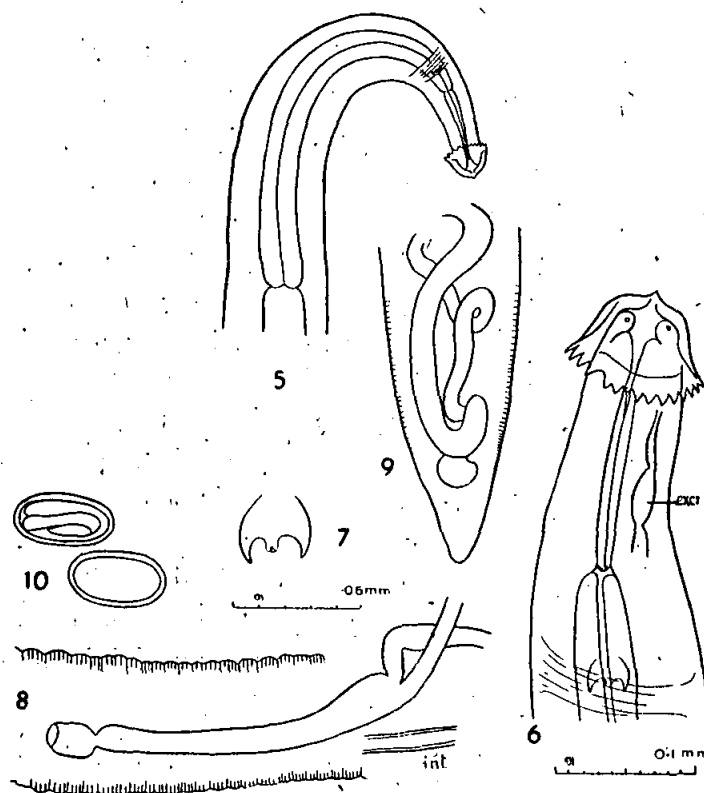
Ainsworth (1915, 193, 235) referred to the presence of worms in the flesh of fish at Macquarie Island. Waite determined the latter as *Notothenia macrocephala* and *N. colbecki* (Waite 1916, 68, 69). The reference is intended to worm cysts and the term "flesh worms" includes those found along the walls of the digestive tract and below the peritoneum of the body wall. Waite's specimens from *Notothenia* spp. have been recorded above as *Anisakis* sp. This author referred to these occurrences (1916, 6, 69, 70) and drew attention to the presence of similar parasites in *N. microlepidota* at the Snares, as well as in the Auckland Islands (where their presence had been already recorded by Hutton, Tr. N.Z. Instit., 11, 1879, 340); and in *N. colbecki* (p. 6, 70) from Antipodes Island. The last reference relates to Waite's earlier mention (1909, 594) of internal worms in this species. For convenience of reference I am listing all of these larvae as *Anisakis* sp., though some of them may belong to *Porrocaecum* or to *Contracaecum*.

Railliet and Henry (1907, 10) mentioned the occurrence of larval *Ascaris* sp.—no doubt an Anisakine—encysted in the subperitoneal tissues of *Notothenia coriiceps* in the region of the Antarctic visited by the "Français."

## PARYSERIA ADELIAE n.g., n.sp. Figs. 5-10.

In the stomach of an Adelie penguin, *Pygoscelis adeliae*, from Commonwealth Bay, a few nematodes were collected, amongst them being two representatives of the Spirurata (Acuariidae); both females. The total length is about 20 mm. with a maximum width

estimated to be 0.25 mm., the specimens being distorted on account of the inward collapse of the body wall. The breadth immediately behind the denticulate collar measures 0.07 mm. increasing gradually till it reaches 0.23 mm. at the level of the junction of the oesophagus and intestine. For the greater part of its length the worm has apparently a uniform diameter of 0.28 mm., narrowing quite near the posterior end. At the level of the anus the diameter becomes 0.1 mm., diminishing rather rapidly to form a short conical tail with a minute rounded apex, which lies about 0.15 mm. behind the anus. The body is annulate but the rings are very low, rounded and inconspicuous, even when viewed marginally, except in the posterior half where they become more



*Paryseria adeliae.*

Fig. 5.—Anterior part of worm. Fig. 6.—Head region. Fig. 7.—Cervical papilla.  
Fig. 8.—Portion of female ducts. Fig. 9.—Tail. Fig. 10.—Egg.

obvious and show from two to six striae. At the level of the posterior end of the oesophagus they are  $7.5\mu$  apart; at the level of the vulva,  $13\mu$  apart; and at the level of the anus only  $3.3\mu$ .

The anterior end is more or less rounded and bears two small pointed lips. The cuticle is modified to form a kind of cap or covering whose posterior border is strongly denticulate or serrate, this border projecting from the body wall to a distance of about 0.01 mm. There are about 26 triangular teeth, each about 0.01 mm. long with a width of about  $7\mu$  at the base. The length from the apex of the lips to the tip of the teeth is about 0.08 mm. and the breadth at the free margin of the collar, including the teeth,

is 0.10 mm., but excluding the teeth the width is 0.09 mm. The cervical papillae lie at 0.30 mm. behind the anterior end and are at the level of the nerve ring. Each papilla is tridentate, the outer teeth curved and pointed and the middle one shorter and rather more blunt. These papillae measure 0.03 mm. in length and in maximum breadth. The excretory pore lies slightly behind the denticulate collar.

There is a distinct vestibule about 0.03 mm. in length, succeeded by a long tubular pharynx, 0.013 mm. in length by 0.01 to 0.013 mm. in width, which enters the oesophagus. The latter is about 0.9 mm. long, 0.03 mm. wide near its junction with the pharynx, increasing to 0.07, or even 0.1 mm., just in front of its union with the intestine which is 0.12 mm. wide in the vicinity, but narrows to about 0.05 mm. more posteriorly.

The posterior coil of the female gland reaches to within 0.18 to 0.3 mm. of the end of the worm. The vulva is in the posterior half of the parasite and divides the body length, 5 : 3. It is a small circular aperture, not projecting obviously from the surface, but leading down into a short narrow canal with cuticularised wall to enter the ovejector with relatively thick walls and a diameter of about 0.08 mm. in its outer region, though it narrows somewhat in its inner portion (0.06 mm.) and eventually receives the two long narrow uteri which fill most of the available space in the worm, except towards each extremity. A fragment consisting of the posterior half of a female was also present in the material. It was not distorted and its diameter was 0.3 mm., narrowing rather rapidly just in front of the anus. The anal region was 0.1 mm. in width, the aperture lying at 0.15 mm. from the posterior end. This fragment showed the greater part of the ejector as well as the narrowed portion of the two uteri extruding from the cut end. The ejector was 0.8 mm. in length from the vulva to the junction with the uterine tubes. The latter were 1.4 mm. long by 0.04–0.05 mm. wide, with thick walls, and in the lumen eggs were lying in a single row. These ducts each widened suddenly into the thin-walled uterus, about 0.25 mm. in diameter, and containing an enormous number of eggs.

The general arrangement of the female apparatus resembles that figured by Seurat (1916; figures in Cram 1927, fig. 327 a-c) for *Seurattia shipleyi*. Eggs are present in enormous numbers and are broadly-elliptical, 0.038 mm. long by 0.02 mm. broad, and contain a coiled embryo more than 0.1 mm. long by 0.005 mm. wide. This parasite is obviously related to *Streptocara*, *Seurattia*, and especially *Yseria*, genera which Chitwood and Wehr (1932, 108) have removed from the Acuariinae and placed in a special sub-family, Seurattiinae. It seems to me that they fall naturally in the Acuariinae, as the specialised collar appears to be derived from the cordons which characterise most members of the latter group. *Yseria* was stated by its author, Gedöelst (1919, 901), to be closely related to *Histiocephalus*. It has also been placed in the Schistorophinae with whose type genus it shows some affinity in regard to cephalic armature. Baylis and Daubney (1926, 220), and Yorke and Maplestone (1926, 359) suppressed it as a synonym of *Streptocara*, which the former authors assigned to the Acuariinae, while the latter placed it under Physalopterinae. Cram (1927, 292) considered *Yseria* valid.

and allocated it to Schistorophinae. The character of the armature, together with the special type of cervical papilla, allies *Yseria* with *Seuratia* and *Streptocara*, as Chitwood and Wehr suggested (1932; 1934).

The antarctic parasite is nearest to *Yseria*, but differs from its genotype in possessing a definitely denticulate collar, rather than a festooned margin. *Seuratia* differs from it in the shape of the collar, as well as in the arrangement of its teeth, together with the presence of body spines. The collar differs in form and extent from that of *Streptocara*. In view of the differences, it seems advisable to regard the parasite of the Adelie penguin as the type of a new genus, *Paryseria*, belonging to the Acuariinae (or Seuratiinae) and differing from *Yseria* and related genera in the features mentioned. Type *P. adeliae*. *Yseria*, *Seuratia* and *Paryseria* appear to be more closely allied to each other than they are to *Streptocara*. One species of the last-named has been reported from the sub-Antarctic, viz., *S. cirrohamata* (Linstow 1888) Skrjabin 1916, collected by the "Challenger," from *Phalacrocorax verrucosus* from Kerguelen. A locality has not been associated with this parasite in any of the descriptions, and the worm is not mentioned in the "Challenger" Summary (Part I, -p. 464), though Linstow's identifications of *Ascaris simplex* from *Otaria jubata* and *Ascaris spiculigera* from *Phalacrocorax verrucosus* are listed. Linstow (1888, 8) described it as *Filaria (Spiroptera) cirrohamata* from specimens labelled "*Ascaris* from the stomach of *Phalacrocorax verrucosus*, along with *Ascaris spiculigera*." The bird is restricted to Kerguelen and its neighbouring islets. The parasite has cervical papillae somewhat like those of *Paryseria adeliae*, as also have *Echinuria squamata* (Linstow), *Streptocara triaenucha* (Wright) and *S. tridentata* (Linstow).

The presence of nematode parasites in penguins seems to be very rare. Railliet and Henry (1907) referred to their absence from the French Antarctic collections. They have not been collected (or at least reported on) by any of the Antarctic Expeditions (except an undetermined specimen taken by the "Scotia"), though I was fortunate to obtain a few during the British, Australian, and New Zealand Antarctic Research Expedition of 1929-31. Linstow (1907, 470) referred to the finding of a single-coiled indeterminable nematode (*Ascaris* sp. ?), 51 mm. long by 1.74 mm. broad, in the stomach of *Catarrhactes chrysolophus*—"Scotia" Expedition, South Orkneys. This is the macaroni penguin, *Eudyptes chrysolophus*. The worm was, perhaps, a larval form ingested along with the food.

Linstow, in his list of the sub-Antarctic parasitic nematodes (1896, 15) included *Spheniscus papua* (i.e., *Pygoscelis papua*) amongst the hosts of *Ascaris* (i.e., *Contracaccum spiculigera*), which is a typical parasite of cormorants, pelicans and their allies. This must be a misprint for *Phalacrocorax verrucosus*, from which Linstow had already recorded it—in fact, the only southern host from which, up to that date, the worm had been recorded. The references quoted by Linstow (1896) do not mention this penguin as a host, and Cram (1927) does not include it in her lists. It should be removed from the list of known hosts for *C. spiculigerum*.

Cram (1927, 235) reported finding *Cosmocephalus obvelatus*—a species collected from various hosts, chiefly gulls and shore-frequenting charadriid birds—from a penguin, *Catarrhactes* (i.e., *Eudyptes*) *pachyrhynchus*. No locality was given for this particular occurrence, but the Zoological Gardens, Washington, D.C., were mentioned in connection with the parasite, so, perhaps, this bird, the Victoria penguin (which is restricted to New Zealand and the neighbouring islands, rarely straggling to the coast of south-eastern Australia), may have received its infection indirectly from a normal host there. Apart from this record, the parasite has not yet been reported from any southern bird.

While discussing the nematode parasites of penguins, attention may be drawn to the following remark—Elton (1927, 81-2), in referring to a record by G. H. Wilkins (quoted by F. Wild in "Shackleton's Last Voyage," Appendix 2, 1923, p. 335) relating to bird life in the South Shetlands, wrote as follows:—"On Elephant Island there is, in summer, a colony of nesting gentoo penguins (*Pygoscelis papua*), and haunting these colonies are a certain number of birds called paddies (*Chionis alba*). The paddies live largely upon parasitic nematode worms, which pass out from the intestine of the penguin with their excreta. In winter the paddies become very thin, owing to the absence of the penguins, on which they depend in summer. These instances show that it is not possible to neglect the existence of parasites as a food supply for other animals . . ." This reference is, I believe, based on an error of observation. During the course of my own work in the South, I noticed the prevalence of small whitish worm-like forms in the excreta of sub-Antarctic penguins, and was disappointed to find, on microscopic examination, that they were not worms, but the cuticular remains of appendages of crustaceans, especially Euphausians, on which such penguins, at times, largely feed. The paddies (*Chionis* spp.) resemble gulls in some of their feeding habits. The reference to these birds depending on parasitic nematodes from penguins as an important part of their food supply can be ignored, since the statement is, I believe, founded on a mistaken observation.

#### REFERENCES TO COLLECTIONS OF SUBANTARCTIC AND ANTARCTIC PARASITIC NEMATODES.

The terms, sub-Antarctic and Antarctic, are employed more or less in the sense used in my report on the Cestodes of the Australian Antarctic Expedition (Johnston 1937), though I have here included the islands lying to the south of New Zealand. Tierra del Fuego and the Falklands are not included.

In this section, the names used for the parasites are those given by the authors concerned, but in those cases where they are synonyms of an earlier species, then that fact is noted and the present generic assignment is added.



"*Erebus*" and "*Terror*," 1839-43.—The first nematode to be described from the southern regions was *Ascaris similis* Baird (1853), the host being stated to be an Antarctic seal. The association of the description of the nematode with that of certain cestodes (*Taenia zederi* and *Bothriocephalus antarcticus*), and the fact that the material in each case was presented to the British Museum by the Admiralty as having been "collected by the late Antarctic Expedition," indicate that it must have been taken by Sir James Clark Ross' scientific staff. Baylis re-examined the specimens (1916), referred them to *Anisakis* (1920), and recently (1929, 543) recognised the species from a sea elephant from South Georgia.

"*The Challenger*" (1874-76).—Linstow (1888) recorded *Ascaris simplex* (which was really *Porrocaecum decipiens*, according to Baylis, 1916), from *Otaria jubata*; *Ascaris spiculigera*, and *Filaria (Spiroptera) cirrohamata*, from a cormorant; and *Ascaris macruroides*, from a fish, *Macrurus* sp. The first three were collected in Kerguelen, and the third at Station 147, in 1,600 fathoms. Regarding the last-named, the locality was 46° 16' S., 48° 27' E., just to the west of the Crozets. In the "*Challenger*" Summary of Results (vol. I, p. 455), *Macrurus armatus* is mentioned as the only fish taken at that station, consequently it can be listed as the host of *Contracaecum macruroides*, this generic assignment being based on Linstow's account.

Regarding the identification of the host of Linstow's *Ascaris simplex*, the seal is mentioned in his report, as well as in the Summary of Results (vol. I, p. 464), as *Otaria jubata*, January, 1874. In Turner's report on the seals collected by the expedition ("*Challenger*" Reports, 26, pt. 68, p. 36) it is stated that on that date, two skinned carcasses of the fur seal, *Arctocephalus gazella* (Peters), had been obtained from a sealing vessel in Kerguelen; whereas *Otaria jubata* was the South American sea lion, and was represented by two specimens obtained at the Falklands. *Ascaris simplex* Linstow (nec Rudolphi), from *Otaria jubata*, Kerguelen, should accordingly now appear as *Porrocaecum decipiens* (Krabbe), from *Arctocephalus gazella*. Linstow's host name was no doubt based on an incorrect identification made by the zoological staff of the ship at the time of collecting. Recent investigations indicate that *Otaria* (or *Eumetopias*) *jubata* Forster occurs also on the North American Pacific coast, where it is generally known as *Eumetopias stelleri*; this species being the commoner of the two kinds found near San Francisco, United States of America.

*The Belgian Antarctic Expedition ("Belgica")*, 1897.—Garin (1913) reported *Physaloptera quiarti* (= *Porrocaecum decipiens*) and *Ascaris falcigera* (= *Contracaecum radiatum*) from a Weddell seal.

*British National Antarctic Expedition ("Discovery")*, 1901-4. No parasitic nematodes were specially reported on; but Baylis (1920, 256, footnote) referred to the presence of *Contracaecum spiculigerum* in *Phalacrocorax campbelli* ("*Discovery*" collection). This bird is restricted to Campbell Island (Alexander, 1928), a locality which was not visited by that expedition, though it spent a few days at Auckland Islands on the

homeward journey (March, 1904). In the latter group a closely-related bird, *Ph. colensoi*, occurs, this species having been collected by Dr. Wilson and mentioned casually in his report on the birds. The "Southern Cross" (1898) called at Campbell Island, and its material went to the British Museum.

Waite (1916, 581) mentioned Auckland Island as well as Campbell Island as localities for *Ph. campbelli*, immature specimens of the two species being similarly marked and indistinguishable, this fact, perhaps, being responsible for his statement. Alexander, in his "Birds of the Ocean" (1928), listed the two as distinct and restricted each to its particular island group, though he stated that they might perhaps be regarded as representing merely two subspecies of the more widely-distributed *Phalacrocorax carunculatus*. If the material examined by Baylis was taken by the "Discovery," then the host must have been *Ph. colensoi*, but if the host were *Ph. campbelli*, then the specimens were probably taken by the "Southern Cross." Wilson (Appendix 2, Scott's Voyage of the "Discovery") referred to the presence of threadworms in the intestine of a sea elephant collected at McMurdo Sound, Ross Sea.

*Scottish National Antarctic Expedition ("Scotia") 1902-04.*—Linstow (1907) recorded *Ascaris rectangula* (= *Porrocaecum decipiens* according to the present report), *A. radiata* and *A. osculata* from Weddell seals; *A. diomedae* from an albatross; and *Ascaris* sp. from a crested penguin, South Orkneys.

*First French Antarctic Expedition ("Français") 1903-05.*—Railliet and Henry (1907) recorded *Ascaris falcigera* (= *Contraecum radiatum*), *A. stenocephala*, *A. osculata* and *A. decipiens* from various southern seals; *Ascaris* sp. (larva) from *Notothernia*; and an undetermined form (fragmentary) from a nemertine, *Cerebratulus charcoti*. It is here suggested that the last-mentioned form, 15 cm. long, may have been the fractured proboscis of the 30 cm. nemertean, as it is hard to imagine that a parasite of such length could be accommodated in a solid-bodied worm of such dimensions. Graham Land and adjacent islands.

*The Second French Antarctic Expedition ("Pourquoi-pas") 1908.*—The parasitic nematodes were not reported on, though Gain (1913, 46, 57) recorded finding them in the stomach of three specimens of the gentoo penguin, *Pygoscelis papua*, from Petermann Island. He mentioned that they were probably parasites of fish which had been eaten by the birds.

*The British Antarctic Expedition ("Terra Nova") 1910-1913.*—A goodly collection was brought back and identified by Leiper and Atkinson (1914; 1915). The parasitic nematodes included *Kathleena radiata*, *K. rectangula* (= *Contraecum stenocephalum*), *K. osculatum*, and *K. scotti*. The remaining species were taken beyond the limits of the regions under consideration. Some errors have crept into their reports. They have included (1914, 223, 225; 1915, 58, 59) *Crassicauda crassicauda* (of Leiper and Atkinson, nec Creplin—renamed *C. boopis* by Baylis in 1920) and *Kathleena* (i.e., *Contraecum*) *scotti* as having been taken in the Antarctic zone (1915) or within the Antarctic circle

(1914). The former parasite came from Northern New Zealand, and the latter from a subantarctic locality, Campbell Island. The echinorhynch, *Pomphorhynchus turbinella*, is also recorded wrongly (1914, 223; 1915, 50) as having been taken in the Antarctic by the expedition's biologist, whereas it, too, came from Northern New Zealand. These authors (1915, 57) wrongly included a cestode, *Monorygma dentatum*, amongst the "Scotia" nematodes, due, probably, to the fact that Linstow described it in his report on the nematodes of the Scottish Expedition. Railliet and Henry's material (1907) was attributed (1915, 58) to the "Pourquoi-pas," whereas it was taken by the First French Expedition ("Français").

*Expedition to the Subantarctic Islands of New Zealand* (1907).—The expedition which visited the subantarctic islands of New Zealand brought back a few nematodes, but they have not been studied. In this present report, *Anisakis* sp. (larval stages—based on Waite's remarks (1909; 1916) is recorded from certain fish, namely from *Notothenia microlepidota* from the Snares and the Auckland Islands; and from *N. colbecki* from Antipodes Island.

*The Discovery Committee, Falkland Islands Dependencies*, ("Discovery," "Scoresby").—Officers of this Committee have collected material in South Georgia and South Shetlands, as well as in more northerly localities (Falklands, Tierra del Fuego, etc.). This has been studied by Baylis (1929). The far-southern species include *Anisakis similis*; *A. physeteris*; *Porrocaecum decipiens* (?)—larval stages from the peritoneum and mesentery of various fish in both localities, as well as in the Falklands; *Contracecum rectangulum* (= *C. stenocephalum*) from seals; *Contracecum* sp. (immature) from a whale; *Contracecum* spp. (larvae) from some South Georgia fish; *Cucullanus fraseri* and var. *nototheniae* also from South Georgia fish. Tornquist (1931) has removed the lastnamed species and its variety to *Cucullanellus*.

Parasitic nematodes have not been reported as having been collected by the following scientific expeditions during their visit to the southern regions:—The various astronomical expeditions to Kerguelen; Second French Antarctic ("Pourquoi-pas") 1908; "Southern Cross" 1898; Shackleton's three expeditions—"Nimrod" 1907, "Endurance" and "Quest" 1921-2 (excluding the remarks on supposed nematodes from penguins, referred to by Wilkins—see Elton 1927); Swedish Expedition ("Antarctica") 1901; German South Polar ("Gauss") 1901-3; German Deep Sea ("Valdivia") 1898-9.

*Other Collections*.—Filhol collected nematodes from fish during his visit to Campbell Island (French Expedition to observe the transit of Venus), his material being studied by Chatin (1885). The latter described *Spiroptera campbelli*, from *Notothenia filholi* Sauvage (called *Notothenia filholi* by Chatin); and *Agamonema campbelli* from the flesh of various fish. The accounts are unfigured and so indifferent and lacking in detail as to be valueless. *Agamonema* is used as a term for immature nematodes, yet Chatin mentions the presence of a reproductive system. *Ascaris filholi* is also described

as occurring in fish, but it is not stated whether the specimens came from New Zealand or from Campbell Island. The remaining parasites named in the paper must have come from New Zealand, as the host was an *Apteryx*.

Linstow (1892) recorded *Ascaris osculata* from a sea leopard, and *Ascaris* sp. (fragment) from the sea elephant, German South Georgia Station, 1882-3. The Hamburg Magellan Expedition, whose nematodes were studied by Linstow (1896), did not enter the subantarctic.

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