Issued October 10, 1910.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—BULLETIN 125, PART 1.

A. D. MELVIN, CHIEF OF BUREAU.

THE GID PARASITE AND ALLIED SPECIES OF THE CESTODE GENUS MULTICEPS.

I. HISTORICAL REVIEW.

BY

MAURICE C. HALL,

Junior Zoologist, Zoological Division.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1910.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Animal Industry,
Washington, D. C., June 16, 1910.

Sir: I have the honor to transmit herewith, and to recommend for publication as a bulletin, the accompanying manuscript entitled "The Gid Parasite and Allied Species of the Cestode Genus *Multiceps*. Part 1. Historical review," by Maurice C. Hall, of the Zoological Division of this Bureau.

Mr. Hall has been making a most comprehensive study of gid, and his investigations will furnish an important contribution to our knowledge of this deadly disease of sheep, which has only in recent years been recognized as established in the United States, the first definite evidence of its presence as an enzootic having been published in 1905 in Bureau of Animal Industry Bulletin 66.

It is intended to publish later, as succeeding parts of the present bulletin, the results of Mr. Hall's investigations, now in progress, concerning the morphology and life histories of the parasites in question, as well as the symptomatology, treatment, prophylaxis, etc., of gid.

Respectfully,

A. D. Melvin,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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Cœnurus is the name commonly applied to a larval cestode group of considerable importance to helminthologists from a historical and scientific standpoint, for it was with one of its species, commonly referred to as *Cœnurus cerebralis*, that Steenstrup's theory of the alternation of generations was first completely demonstrated for cestodes by Küchenmeister, who, in 1853, produced the adult cestode or tapeworm in the primary host by feeding the larval form to the dog, and produced the larval cestode or bladderworm in the secondary host by feeding the eggs of the adult tapeworm to the sheep. This work of Küchenmeister's and that of Von Siebold along the same line is taken by Braun (1894a),[a] in his classic work on cestodes, as marking the beginning of the fourth and latest period in helminthology, dating from 1851.

This same species, *C. cerebralis*, is of considerable economic interest to veterinarians and stock raisers, and especially to sheepmen, as being the cause of the disease commonly known among English-speaking people as gid.

In spite of the fact that the disease caused by this parasite, as well as something of its nature, was probably known in the fourth and fifth centuries B. C., and that the parasite itself was observed at least as early as 1634 A. D., its parasitic nature known since 1780, and its life history known for over half a century, there are still some mistaken popular ideas about it, and also some errors, disagreements, and uncertainties in the writings of scientists as to the specific identity of this and various other forms of cœnurus that have been described from different hosts, and also as to the correctness with which certain par-

[a] Bibliographic citations refer, wherever possible, to Stiles and Hassall's (1902–19—) Index-Catalogue of Medical and Veterinary Zoology, Authors, Bureau of Animal Industry Bulletin 39, United States Department of Agriculture. References not in Bulletin 39 are indicated by the use of Greek letters and will be covered in a supplemental bibliography, to be published later.

asites are listed from certain hosts. The writer has endeavored to correct some of these errors in this paper, and it is proposed in a series of papers to give a comprehensive account of the cestodes having a cœnurus larva.

The first form to be considered is the brain bladderworm of sheep, usually known as *Cœnurus cerebralis*, but which, as will be shown, should be known by the name *Multiceps multiceps*, proposed here for the first time. In this article the word "cœnurus" will not usually be capitalized; it will be used merely as the name of a larval stage, like the words "cysticercus," "cercaria," "leptocephalus," etc. It is not entitled to be used as a generic or subgeneric name, owing to the priority of *Multiceps*, but as it is still much more commonly used in this way than *Multiceps*, and as reference must be constantly made to quotations where it is used in combination with some specific name, especially in the form *Cœnurus cerebralis*, it will often be clearer to use this form instead of the correct one.

MULTICEPS MULTICEPS.

HISTORICAL SKETCH.

Braun (1894a) makes his first period in helminthology cover the work of antiquity and the middle ages up to 1600, and in the literature of this period, relatively barren from a scientific standpoint, almost no references are to be found that can be construed as referring to gid. However, a disease like gid, involving, as it does, a delicate arrangement of alternating hosts, must have existed long before primitive man passed from the hunting to the pastoral stage. It is not the sort of disease to arise by rapid facultative adjustment or out-of-hand adaptation. The very fact that gid exists to-day is proof enough in a disease of this sort that it existed thousands of years ago. Undoubtedly, in the days when the ancestral dog pursued the wild sheep, the nice adaptation of a brain parasite that would interfere with muscular activity and blunt the sense perceptions, making flight and escape difficult, must have furnished a striking example of a life habit well calculated to perpetuate a parasite, but it could scarcely have been more satisfactory than the new arrangement introduced by man when he domesticated the sheep and put its former enemy, the dog, in charge of it to run over its pastures as a constant companion and to eat the discarded heads and diseased brains of giddy sheep—an enemy still.

A prolonged search of ancient literature would no doubt show some references which might readily be taken as descriptions of gid. The symptoms are so striking that pastoral peoples, like the Arabs, Jews, and Greeks, must have noted and described them; but finding such references involves a tedious search and more time than can profitably be spent on the work.

One such reference occurs in Kuhn's edition of Hippocrates (1825α), who is believed to have lived 460 to 375 B. C. The following is quoted from Adams's translation of Hippocrates (1886α), describing excess of fluids on the brain in epilepsy:

> This you may ascertain in particular, from beasts of the flock [i. e., sheep] which are seized with this disease, and more especially goats, for they are most frequently attacked with it. If you will cut open the head you will find the brain humid, full of sweat, and having a bad smell.

It is, of course, impossible to make a positive statement of fact on anything less than complete and accurate observations. Obviously there was no one in the time of Hippocrates who could be expected to make and record such observations in a case of gid, and existing editions of Hippocrates are open to the suspicion of having in them observations not properly referable to Hippocrates. Hence we can not say certainly that Hippocrates actually saw cases of gid, but on the strength of the reference given, agreeing as it does with the certainty that gid among sheep must have existed for ages, it is fair to state that Hippocrates probably saw cases of gid four or five centuries before the Christian era. The fact that the brain of sheep was found full of fluid points, among other things, to hydrocephaly, which may follow the invasion of the gid parasite, according to Müller (1877a), or to the gid parasite itself. Gid probably was not rare in those days when sheep were everywhere tended by dogs and the prophylaxis of the disease was undreamed of. The "bad smell" may have been due to delay in post-mortem examination, to hydrocephalus purulentus as a sequel of gid, or it may easily have been noted in the cœnurus vesicle, as my own observations show that the cœnurus fluid serves as an excellent medium for decomposition bacteria, the odor of the fluid in a graduate becoming intolerable in twenty-four hours at ordinary room temperature. Guetebruch (1766α), according to Küchenmeister (1880a), states in an article on gid that when perforation of the skull occurs, as it sometimes does in gid, the brain decomposes and becomes purulent, the brain and bone marrow turning to water and becoming putrid. The writer has never seen such a case, but it is evident that if the perforation of the skull were followed by perforation of the skin as well, it would afford entrance to bacteria, with possibly a result similar to the one given. Finally, the fact that these post-mortem findings are given for sheep suffering from "the sacred disease," a term covering epilepsy and other brain disorders, would indicate the possibility of gid, as the symptoms of nervous disturbances are very marked in this disease. Adams, the translator of Hippocrates from whom the foregoing quotation is taken, and himself a physician, refers to the lines quoted as follows:

> It is well known that this is also the case with sheep, and that they are subject to the disease called the sturdy [i. e., gid], which is indisputably a sort of epilepsy.

In the somewhat limited literature on helminthology for the period from 1600 to 1800, Braun's (1894a) second period, the gid parasite figures to a proportionally large and increasing extent. The citations from this period are given rather fully, as they are in works which are not readily available to many.

In the first part of the nineteenth century, Braun's (1894a) third period, there are numerous references to gid, and since 1850 and the work of Küchenmeister, which was done soon after, not a year has passed in which few to many notes on the brain bladderworm, its adult tapeworm, or its effects, have not appeared. This increase in the amount of literature is perhaps concomitant with an increase in number and distribution of sheep and cases of gid, as well as with increasing knowledge of the parasite. In general the large amount of literature is due to the attractive combination of scientific and economic interest which has induced many persons to publish notes on the disease and its parasite from one or both standpoints.

The early notes on cœnurus deal only with *Cœnurus cerebralis* (= *Multiceps multiceps*) and especially with the disease caused by it. It was nearly two hundred years after Scultetus (1672a) had seen the first unmistakable case of gid that I have found recorded, before the first cœnurus which we may regard as other than *C. cerebralis* was noted by De Blainville (1828a). Scultetus saw his case in 1634.

The first available note published during Braun's (1894a) second period of helminthology dealing with *C. cerebralis* is that of Rolfinck (1656a) who, in a work on medical anatomy, writes of vesicles full of water and humor in the third ventricle of sheep as the cause of a vertigo. This may be safely accepted as a reference to *C. cerebralis*. The description is in general terms just the one a casual observer would give of this parasite, as witness the statement of a correspondent to the veterinary editor of a periodical (Vet. Ed. Amer. Shepherd's Bulletin 1903γ) to the effect that he found in a sheep's head "a bag of water which burst and ran out when I pressed upon it."

The next available article on the subject of gid published during this period is that of Wepfer (1658a). The part relating to *C. cerebralis* gives at this early date notes on the characteristic symptoms of the disease, its pathology, and the morphology of the water bladder. The disease is further recorded as a frequent cause of death in cattle, and the peasants are credited with a form of operation involving percussion and surprisingly good for that date.

Heusinger (1853α) quotes from a work of Bartholinus (1667α), not available to me, a statement of a species of frenzy and vertigo which in 1661 attacked horses, cattle, and sheep, and notes that worms were found in the heads of the animals attacked. These cases may have included, and very likely did include, cases of gid.

The next available article dealing with *C. cerebralis* is that of Scultetus (1672a), who in a Latin treatise on surgery gives the

description of a case seen at the earliest date at which we have found a case recorded. The following is quoted from an English translation of the same work (Scultetus, 1674a):

Observation X. Of a Vertigo in a Sheep, proceeding from an Abscess in the Brain. In the Year 1634, December the 24th. Being in the shop of Nicolas Kite[a] he made mention of his sheep, among which one was troubled with a Vertigo, or Giddiness, the Germans call it *Wirbling:* this Disease one who dealt in sheep affirmed to be incident to the fairest of the Flock; that hereby their whole Brain would be turned into Water and then they would fall down dead on a sudden. The Chyrurgion therefore commanded that one of those sheep which was weakened with this Giddiness, and turning around, should be killed, and sent me the head.

Scultetus found nothing in the ventricle.

Afterward I lifted up the organs of smelling * * * and on the left-side, between the Brain and the Pia mater, I found an abscess, like the Bladder of a Fish, full of very clear water * * * I wondered that * * * the sheep should not labour under an Apoplexy, or a Palsy, rather than a Vertigo.

In 1645 Scultetus lost a sheep by the same disease, and in the work just noted writes:

I dissected the Head * * * and presently on the left-side as it were of the backward part of the Head, under the Dura Mater, I found a Bag of the thickness of a Fisches Blader, filled with Water, and little Worms, such as are bred in Cheese; for it began to putrefie at the bottom. This Coated Tumour being bigger than a Hens Egg, had so insinuated itself into the substance of the Brain, that it did somewhat press upon the third Ventricle. This Sheep, as the Shepheard reports, turned herself round about towards the night[b] all that day she dyed.

That gid was not uncommon in the seventeenth century is clear from the fact that Rolfinck (1656a), writing of vertigo, refers to it as *occasionally* (nonnumquam) caused by sacs of water on the brain in sheep. Wepfer (1658a) notes it as a serious and common disease of cattle in Switzerland. In the account of Scultetus (1674a) it appears that a sheep dealer recognizes the disease as one common enough in Germany at that time to have a colloquial name, "Wirbling."

The next reference to gid is by Wepfer (1681a) and is identical with the one already given, being in a later edition of the original work of 1658.

Küchenmeister (1880a) refers to an article by Brunner (1694α), not available to me, and quotes from it a statement to the effect that Brunner had dissected the head of a giddy calf, "vituli vertiginosi," and in the cerebral substance had found three hydatids the size of pigeon eggs and full of limpid fluid. Küchenmeister takes this to refer to *Cœnurus cerebralis*, which it obviously does.

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[a] The original Latin text reads "in tonstrino Nicolai Reutte." The translator has translated not only the text but also the proper names, rendering the German name Reutte by its English equivalent, Kite.

[b] This last statement should read "towards the right," the Latin word here being "dextram."

The next reference is in Wepfer (1724a). The first two parts of this article consist of the two parts making up the edition of 1658. With these is incorporated a third part. The same references to gid occur in the parts already published and referred to above. In the new part is a new reference to hydatids in the brain of cattle as being commonly believed to be the cause of the vertigo accompanying them. He has seen the peasants perforate the skull and extract these in operations and has also seen the hydatids demonstrated post-mortem.

Hoffberg (1759a), in a dissertation on *Cervus tarandus*, first presented in 1754, writes under the heading of diseases of this animal, of a vertigo or "Ringsjuka" causing the reindeer to turn in circles. Braun (1894a) takes this as a reference to *Cœnurus cerebralis*, which is a perfectly reasonable assumption. The presence of the parasite in the reindeer, however, is unsupported by post-mortem evidence in this reference, and, so far as I am aware, such evidence is lacking in any subsequent writings. The occurrence of the gid parasite in the reindeer must therefore be considered doubtful. It seems the more doubtful in that Brehm (1877α) states that reindeer are attacked by the larva of a gadfly, specified by Moniez (1880a) as *Cephenomya trompe*, which penetrates from the nasal cavity to the brain, causing a fatal "Drehkrankheit" or gid, and it may have been this disease, apparently a common one, which Hoffberg saw.

Küchenmeister (1880a) quotes from a treatise on diseases of sheep by Guetebruck (1766α), already noted as not available. In this treatise it is stated that the disease attacks lambs and yearlings, but not old sheep; that some are born with it; that a water bladder forms on the brain and may penetrate the skull; that when the disease has not gone too far the flesh may be used and the head and feet thrown away [very bad advice], but if the disease has gone too far the entire carcass should be done away with. As a method of treatment he gives venesection on the temple and nose.

Stier (1776a) has an article on gid, of which only the review was seen by me, the original (Stier, 1775a) not being available. The article takes up a long list of supposed causes of gid and rejects them, the water bladder in the head being held guilty of causing the trouble. Stier also draws a careful distinction between actual gid due to *C. cerebralis* and simulated gid due to the presence of *Œstrus* larvæ in the nostrils, the latter presenting the symptoms most commonly mistaken for gid.

According to footnotes in Bloch (1780a), Hastfer (1776α) and Ranstler (1776α) have published references to gid, but these are not available. Bloch states that they attributed gid to the bladder on

the brain, and that Ranstler was the first to notice the small bodies on the bladder and surmised that worms arose from them.

According to Braun (1894a) and others, the cestode nature of the water bladder found in the brain of giddy sheep was first pointed out by Leske (1780a) and by Goeze (1780a), independently. These references are not available to me. Braun notes that Goeze recognized the cestode heads and considered them as the embryos of the bladderworms which are found in the omentum and liver of sheep and swine. He also notes that Leske found *Tænia multiceps* (= *Cœnurus cerebralis*), recognizing the characteristic hooks and suckers. Küchenmeister (1880a) quotes part of Leske's article showing that Leske made a very careful study of the morphology and pathology of the parasite. He noted the heads invaginate and evaginate through the bladder wall. From the presence of so many of these heads, he observes that we may consider the animal as many tapeworms attached to a common bladder, or as one tapeworm with many heads. Hence it would be appropriate to call it the many-headed tapeworm, so he names it *Tænia multiceps*.

This last is important, as it establishes the fact that the correct specific name of the gid parasite is *multiceps*. The preceding note from Braun (1894a) confirms the correctness of Küchenmeister's (1880a) quotation, and in addition Mr. Sherborn has very kindly verified the reference in the library of the British Museum. It appears from evidence to be considered later that Leske's work antedates that of Goeze in the same year. Were it otherwise, Goeze's article need not be considered, as, according to Braun's synopsis, he regarded the heads of the parasite as the embryos of the bladderworms found in the omentum of sheep and swine, and hence presumably proposed no new name for the brain parasite, as there would be no reason for it under the circumstances or a proper application for the name had he done so.

In a discussion of the synonymy of this parasite, Stiles and Stevenson (1905a) accept as the specific name the one proposed by Bloch (1780a). Bloch makes the genus *Vermis vesicularis* for the bladderworms, and divides these into three species, of which *Vermis vesicularis socialis* is the brain bladderworm of sheep. But though this article of Bloch's bears the same date as those of Leske and Goeze, viz, 1780, Leske's article is nevertheless older, and the name proposed by him is therefore entitled to priority. This is evident from Bloch's own article, which shows that Bloch had read Leske's article of the same year. Bloch states that Ranstler first noticed the small bodies on the bladder walls and surmised that worms arose from them, but that Leske and Goeze observed that these bodies were actually bladderworms. He states that Leske has described them

very completely and figured one accurately. Bloch very significantly adds that Leske numbered the parasites among the tapeworms, "Bandwürmer," where, according to Bloch, they can not properly be reckoned, for reasons already given by him.

It is evident from the last statement that Bloch had not overlooked Leske's *Tænia multiceps* and that he believed he was correcting an error by proposing the name *Vermis vesicularis socialis*. However, subsequent work on cestode life history has shown the invalidity of all classifications which place vesicular worms in a group apart from the strobila forms and has justified Leske's judgment in uniting them.

Unfortunately for Leske's name, Rudolphi (1810a) did not list it as a synonym of *Cœnurus cerebralis*, although he listed Leske's article in his bibliography. For this reason Leske's name has been very generally overlooked, as research in nomenclature has commonly gone back through Rudolphi to the names quoted by him. Stiles and Stevenson (1905a) do not give Leske's name, *Tænia multiceps*, in their table of synonymy, and in selecting the oldest name available to them have overlooked the rather obscure references to Leske's unavailable article. On calling Doctor Stiles's attention to the omission he pointed out to me that Sherborn (1902a) refers to Leske (1780a) with the comment "No n. spp." I wrote Mr. Sherborn, asking him to verify this reference, which he very kindly did. In a personal communication he quotes substantially the part quoted by Küchenmeister (1880a), and states that he overlooked the name in his former reading. Mr. Sherborn was also good enough to supply copies of Leske's illustrations. These show very close observation.

Following the independent discoveries by Goeze and Leske of the cestode nature of the water bladder from the brain of giddy sheep, there arose some controversy as to which of them was entitled to priority. According to Braun (1894a), Boerner (1780a) published an article discussing this point and holding Goeze as the discoverer. Subsequently, Goeze (1782a) repudiated Boerner's article, deploring the misunderstanding between himself and Leske. He states that he has explained the situation in a previous publication, the date of which is not given and which is unavailable to me. Leske's priority is conceded by Rudolphi (1808a) and by Davaine (1860a). The matter of priority here is apparently not concerned in the nomenclature, and what honor lies in priority of discovery belongs to Leske, so far as the available evidence shows.

Goeze (1782a) divides his genus "*Tænia*, Bandwurm," into two main classes as he calls them—*Tænia visceralis*, the visceral tapeworms, and *Tænia intestinalis*, the intestinal tapeworms. Under the former he lists, among other species, "*Tænia vesicularis cerebrina*"

from the brain of giddy sheep, *Multiceps*, the many-headed, with many heads and bodies in a common bladder. And later on he states that from the numerous heads one may call the parasite "Vielkopf (*Multiceps*)."

From the above, Stiles and Stevenson (1905a) have taken the generic name *Multiceps*. The generic name used by Bloch (1780a) is evidently unavailable, being composed of two words and therefore contrary to Article 8 of the International Code of Zoological Nomenclature, as given by Stiles (1905y): "A generic name must consist of a single word, simple or compound."

Rudolphi (1809a) rejected Bloch's *Vermis vesicularis* as incongruous and unsystematic. Sherborn (1902a) is in error in listing *Vermis* Bloch 1782 as a generic name. The combination *Vermis vesicularis* is always used, whether with or without various specific names attached.

As heretofore shown (p. 11), the earliest specific name of the parasite is that of Leske (1780a) as given in the name *Tænia multiceps*. If the parasite in question is to be removed from the genus *Tænia*, then the new combination must use the earliest available generic or subgeneric name, and since Goeze's (1782a) use of the scientific name *Multiceps* is evidently generic or subgeneric in intent, being clearly used to distinguish the many-headed gid parasite from the single-headed cysticercus forms, it is necessary to use it in the new name.

The tendency for some time, and certainly a desirable tendency, has been to break up the large and heterogeneous group of animals formerly listed in the genus *Tænia*, and to restrict the use of this name. The present situation has already been stated by Stiles (1905y) as follows:

> Most authors recognize that *Tænia* is to be divided into the subgenera *Tænia*, *Multiceps* (i. e. *Cœnurus*), and *Echinococcus*. Some authors, however, incline to recognize these subgenera as of full generic rank.

It seems advisable to restrict the generic name *Tænia* to those forms which have a cysticercus stage in the life history. These alone make up a large group with a fairly close similarity in the adult and larval stages. To retain in this already large genus forms having a cœnurus or echinococcus larva seems unnecessary and undesirable. Long ago Leuckart (1886d) wrote:

> The *Cœnurus* * * * is related to the *Cysticercus* as a compound to a simple animal—a sufficient reason for systematic zoologists to separate them.

Generic rank is accorded to particular groups of species which in the course of evolution have attained distinctive characteristics, and I see no reason for withholding such rank from forms in which these distinctive characteristics occur in the larva instead of the adult. This point is of especial importance in a case of this sort

where the animal is found in the larval stage in the great majority of cases, the adult being seldom seen or recognized. This view is in accord with that of Stiles and Stevenson (1905a), from whom the following is quoted:

> Opinions may differ as to whether this group [*Multiceps*] should be given generic or subgeneric rank. Personally we see no serious argument against recognizing a distinct genus on basis of the "larval" stage.

Adopting, then, the genus *Multiceps* Goeze, 1782a, and the species *multiceps* Leske, 1780a, as the oldest available names, the correct technical name of the gid parasite is *Multiceps multiceps* (Leske, 1780a), Hall, 1910β.

From 1782 to 1800, the latter date marking the beginning of Braun's (1894a) third period in helminthology, numerous observations were made on gid, most of them merely confirming the previous work of Leske, Goeze, and Bloch, or adding minor points of more or less importance and interest. By 1800 the gid disease had been observed certainly for over a century and a half and very likely for twenty-two centuries, its parasite had been named, described, and figured, and had a fairly large number of synonyms in addition to its correct name, the symptoms and pathology of the disease had been given, together with the symptoms of diseases simulating gid, and methods of operation had been used which only lacked aseptic precautions to make them equivalent to good modern methods, and which were as good, perhaps, as most methods now in actual use.

There remained, then, the work of finding out the life history and basing on that a rational prophylaxis. As a matter of fact the discovery of this life history by Küchenmeister and Von Siebold marks the beginning of the fourth and last period in helminthology. The contributions of the third period to the subject of gid are largely wrong and unnecessary theories of causation as well as unsatisfactory methods of treatment. In addition, the large amount of literature in this period lists the parasite from several new hosts, often erroneously, and adds considerably to the synonyms by which it is known. During this period new records of the disease show a widening geographical distribution, and unsatisfactory and unsubstantiated statements of its presence in the United States begin to appear as early as 1809. The essential contributions in the literature of this period have been covered in tables and discussions to be given later, and the important events marking the modern period of helminthology may next be considered.

Von Siebold (1844a) proposed as an explanation of the true nature of bladderworms that they were cestode embryos which in attaining a new host had gone astray, ending as encysted, incompletely developed forms. Thus *Cysticercus fasciolaris* of the mouse was held to be such an incomplete sexless modification of *Tænia crassicollis* of the

cat. He ventured to predict that in time the various tapeworms would be identified in their relation to certain cysticercus, cœnurus, and echinococcus forms.

Dujardin (1845a) advanced a similar theory, and this view or modifications of it became popular in scientific circles during the five or six years following Von Siebold's publication. It required the experimental work of Von Siebold and Küchenmeister in 1851 and 1852 to complete this half truth. In the meantime the advocates of spontaneous generation lost ground to those who urged that the bladderworms were altered, degenerate cestodes or were incompletely developed embryonal forms.

A prominent champion of the last theory, Küchenmeister (1851c), finally published a note stating that he had produced *Tænia crassicipes* [= *T. crassiceps*] of the fox by feeding *Cysticercus pisiformis*. A little later (Küchenmeister, 1851d) he corrected this statement, changing his identification of the adult worm to *T. serrata*. This marks the beginning of the modern use of the now general experimental feeding methods of determining life histories.

It remained for Von Siebold (1852a), the supporter of the theory of hydropic degeneration of bladderworms, to furnish additional proof that his theory was wrong, for this same year he produced the adult cestode from the gid bladderworm.

The following year Küchenmeister (1853e) succeeded in experimentally demonstrating, for the first time, the entire life history of a cestode. He fed *Cœnurus cerebralis* to a dog and produced a tapeworm which he called *Tænia cœnurus*. He then fed the gravid proglottids of this tapeworm to a sheep, and produced in it the early stages of the cœnurus in the brain.

From this experiment Küchenmeister concludes that sheep are infected in pasture by dogs dropping proglottids. Other animals, he thinks, may also harbor the tapeworm, and he claims this would certainly be true of wolves in Hungary and Poland. This statement is evidently mere assertion, as it is not verified by the record of such a finding either at the time or subsequently. At this date no description of *T. cœnurus* had been published and its anatomy had not been studied. Indeed, the following year Von Siebold (1854b) states that he finds the adult of *Cœnurus cerebralis* to be *Tænia serrata*. While the occurrence of *T. cœnurus* in the wolf is a probability, it is nothing more, so far as all available records show.

On the evidence at hand Küchenmeister formulated a set of rules for the prophylaxis of gid which is practically complete. It is as follows:

1. Feed dry food the year round and do not pasture.

2. Once or twice a year, purge the sheep and dogs in some inclosed place to get rid of tapeworms, and burn the feces.

3. Do not, as is usually done, throw the heads of giddy sheep to the dogs, or, as Küchenmeister after investigation finds to be done, throw the brain to the dogs before cooking the heads. Where there are wolves one must also bury or burn the intestines of those that are killed, and not throw them away to infect the fields.

Such a program is not altogether practicable or necessary, but it only needs trifling amendment to bring it down to date. Had it been adhered to only as regards keeping dogs free from tapeworms and heads of giddy sheep away from carnivora for the last half century, gid would probably have been a rare disease by this, for it is really one of the most readily preventable of diseases.

The next year Küchenmeister's work was confirmed by Von Beneden (1854*α* and 1854*β*), Eschricht (1854*α*), Gurlt—according to Küchenmeister (1854*α*)—Haubner (1854c and 1854d), Leuckart (1854c), and Röll (1854*α*), all of whom produced gid in sheep by feeding proglottids of *Tænia cœnurus* sent them by Küchenmeister.

As a result of these experiments and others performed soon after, the important phases of the life history of the gid tapeworm were determined. It was found that the disease began with an invasion period during which the embryos were migrating through the body. Then followed an interval of apparent recovery, during which the growth of the bladdery vesicle was going on, to the point where the heads became developed and exsertile. Here the third and final stage of gid occurred, the characteristic symptoms, corresponding to particular locations of the parasite, becoming more aggravated with the increase in growth and number of heads until death occurred.

Subsequent work has added to our knowledge of the morphology of the gid parasite, of the symptoms, pathology, and simulation of the disease, and of the need of avoiding bacterial infection in operation. It has added numerous synonyms to the nomenclature, and recorded, correctly or incorrectly, new hosts and new areas of infection, among the latter the United States. No essential points have been added to our knowledge of the life history of the parasite or the prophylaxis of the disease.

GID IN THE UNITED STATES.

The history of gid in the United States is, to a remarkable extent, a matter of conjecture. So far as I have been able to discover, the first claim of its occurrence here was made a century ago by Livingston (1809*α*). His claim is based on very unsatisfactory evidence. The following is a rather full quotation of the case:

> The staggers or dizziness, which is also known by various other names, has occurred in three instances in my flock, and always attacked lambs under one year. * * * They were taken very suddenly * * * by a species of convulsion, in which the neck was twisted to one side; they lost the use of their legs; when raised they would

attempt to follow the flock, but turned round and fell; in a few days they were incapable even of standing, of moving their heads or any of their limbs. As they were very valuable sheep, I paid particular attention to them; grass and grain were given them, which they would readily eat, though they could not move any part but their jaws. In this state they lay a week without motion, except of their eyes and mouth. * * * In about ten days they could stand without support, but fell when they attempted to walk. * * * At intervals they would get better * * * but they were always found laying in some part of the field as if they were dead. * * * In the course of about six weeks they so far recovered as to be able to join the flock; one of them * * * received a blow * * * that killed him; the other two recovered, but very slowly; and even at the end of eight months they bore evident marks of their complaint. This disorder is found, upon dissection, to be owing to a bag containing water within the skull. * * * It may * * * be justly considered as incurable by the doctor, but not, as I have shown, by the nurse. * * * But a sheep must be extremely valuable to pay for three months' constant attention.

It seems unlikely that the above cases were gid. Their occurrence in lambs fits in with the theory of gid, and the general symptoms, though not typical, might have been gid. On the other hand, the alternation between periods of normal activity and entire collapse does not look like gid, and the gradual betterment over a period of eight months runs counter to the clinical history of the disease. Moreover, leaving out the case of the lamb that was killed while recovering, the per cent of recoveries was 100. Some writers have claimed a spontaneous recovery in 2 per cent of all cases, but the writer knows of no evidence showing that any cases ever recover when the formation of the bladder is once under way, and a degeneration of the parasite in its earlier stages, indicated by the brain concretions according to Spinola (1858b), would not give a long period of slow recovery. Moreover, the three scattering cases given would indicate a sporadic infection, not to be expected in the case of gid. Doctor Mohler of this Bureau suggests a meningitis as the particular disease simulating gid in this instance, a theory which seems to fit the case very well. The lack of post-mortem evidence is unfortunate, as even typical cases of gid may be simulated by other things.

Cole (1847α), in a book published in Boston, discussing "Sturdy, or Water in the Head," states:

> A writer on this subject says that he knew a shepherd in Europe that saved nearly all on which he operated in this manner [by trocar], while he himself lost nearly all on which he operated.

This sentence suggests that the writer referred to had operated outside of Europe and most likely in the United States, but this is, of course, mere speculation.

Later, a competent scientist, Leidy (1856a and 1856b) records *Cœnurus cerebralis* in a list of parasites "observed by the author," but does not state whether it was collected in the United States.

McClure (1870α), writing from the United States, says that he has known as many as five cœnuri to occur in the brain of sheep. He

does not specify that this observation was made in the United States, however, or that the disease occurs here.

Verrill (1870d), writing of gid, says: "In this country [United States] the disease is far more common than most persons suppose." Unfortunately, he cites no literature and no cases in support of this statement, and a request for further information has not been answered.

Tellor (1879a) says: "Hydatid in the brain, or turnsick, although reported from New York and other States, is a curiosity rather than a scourge." He does not claim to have seen the disease.

Crutchfield (1880α), of Hamilton County, Tenn., says:

> I have lost a few sheep by "staggers," "turnsick," etc., properly Hydatid on the brain, by allowing the sheep to range upon low, wet, spongy lands. By removing them at once the disease ceased.

The evidence here is not sufficient to enable one to pass judgment on the case. There is no statement of symptoms or autopsy findings, and the cessation of the disease on removing the sheep from low, wet ground might or might not have followed in the case of gid. Hence this case must remain uncertain.

Killebrew (1880α), writing from the same State, Tennessee, in the same year does not claim to have seen the disease, but Stewart (1880a), writing from New York, says of *Cœnurus cerebralis:* "The presence of this parasite has been discovered * * * in numerous sheep in this country."

Stewart's statement is not convincing, but in connection with other things it shows a belief on the part of men interested in the sheep business that gid existed in this country. Later events indicate that their belief and their statements to that effect are quite as likely to have been based on fact as to have been unfounded.

Wernicke (1886a) records *C. cerebralis* from sheep in Buenos Aires. He believes it imported from Europe and states that it is a source of worry to breeders. It seems altogether likely that if gid had been imported to South America from Europe by 1886, it had probably been imported to the United States from the same source even earlier. In this connection, Powers (1887α) writes from New York the following year concerning gid:

> I have never seen a case of this, knowing it to be such, nor have I seen an American shepherd who has met with it. It was probably imported from England, and it seems to prevail chiefly in the Eastern States. * * * I made many autopsies of sheep * * * for the bladder or cyst of this parasite, but I never found one. When the case is long drawn out, the bladder or tumour on the brain by constant pressure on the skull, absorbs it to such a degree that a finger pressed on the spot discovers a soft spot in the plate of the bone, or the latter even bulges out in a protuberance. * * * Twice I have seen this phenomenon in my own flocks and in rude fashion lanced them, thereby saving the sheep.

There is an evident contradiction between the statement that the writer has never seen gid and that he has operated on his sheep for it.

How easy it would be to import a case of gid may be surmised from Rabe's (1889a) case in a gazelle imported from South Africa fourteen days before death. There is also the possibility of importing the adult worm in some of the numerous dogs which have been imported to this country. Professor Law, in a personal communication, writes under date of July 2, 1909:

> Owing to its rapid development in the lamb it is less likely to be imported in the condition of larva, but among the many imported dogs the *Tænia* must have been often imported.

All things considered, the likelihood of importing the disease via the dog is perhaps as great as that of importing it in the sheep, but I would not consider the latter less likely. Rabe's case and others to be considered later show this. Moreover, a possible four to six months is not a very rapid development of disease in these days of rapid transit. An outbreak of gid attributed by Doctor Law and by Taylor and Boynton (1910a) to imported dogs is discussed later in this paper. The writer has collected evidence in Montana indicating that the gid parasite has been imported in dogs in some instances and the disease spread by the sale or gift of these dogs and their offspring.

Nearly twenty years ago, Curtice (1890c) writes of larval cestodes in sheep: "*Tænia marginata* is more common in the United States, and *T. cœnurus* next." He hazards the guess that in the West wolves, coyotes, and foxes may harbor the parasite. In a personal communication Doctor Curtice writes of the above under date of July 26, 1909: "I have never seen *T. cœnurus*. I must have made statement on information by reading."

In another article Curtice (1892g) has the following:

> The tapeworms identified as *T. cœnurus* were found but once in Colorado. The species may have been one arising from rabbit cysticerci and wrongly identified. The specimens were taken from a sheep dog. They are now in the bureau collection.

I have examined these specimens (Nos. 2839 and 2840), and while they are not in good condition it is still possible to determine the essential things. They are not *T. cœnurus*, so far as the material furnishes data on the subject. To mention two evident differences, the eggs are decidedly oval, and the handle of the large hook is of an entirely different shape.

About the year 1895 the subject of gid in the United States begins to receive notice in sheepmen's periodicals. Thus we find gid diagnosed by the veterinary editor of one paper (Vet. Ed. Amer. Sheep Breeder, 1895*a*) in a case where correspondents from an unspecified locality give a history of staggering to the right in an imported

Shropshire ewe. The animal became unable to rise and was killed. On post-mortem examination a third of a teacupful of water ran out of the head. We are obliged to concur in the diagnosis given and consider that the disease was very likely imported with the sheep.

Later in the same year the same diagnosis is given by this editor (Vet. Ed. Amer. Sheep Breeder, 1895β) in a second case from an unspecified locality, with the characteristic symptoms of giddiness or turning, followed by death. Another case is diagnosed as gid on the same symptoms two years later (Vet. Ed. Amer. Sheep Breeder, 1897β).

Sommer (1896c) did not find *T. cœnurus* in an examination of fifty dogs at Washington, D. C.

The adult tapeworm, *T. cœnurus*, was reported from Nebraska by Ward (1896b), but Stiles (1898a) on an examination of the head of the specimen pronounced it *T. serialis*. Doctor Stiles tells me that he based this identification on the bifid guard of the small hook, an inadequate diagnostic character, as the corresponding guard of *T. cœnurus* is also bifid. (See Reinitz, 1885a, and Ransom, 1905d.) On the other hand, the larva and adult of *T. serialis* are known to occur in Nebraska, which makes it likely that Stiles was correct. Ward (1897b) agrees with Stiles that it was *T. serialis*.

Knowles (1897α) writes as follows:

> As numbers of inquiries come to this office relative to gid, or staggers, or so-called turnsick in sheep, I * * * append a well-written description, etc., of this disease by Doctor Curtis. [This should be Curtice.]

Doctor Knowles tells the writer that he saw his first cases of gid in Montana during the year that the above was written, 1897.

Stiles (1898a), writing from this laboratory, says of *Cœnurus cerebralis:*

> Fortunately it does not seem to be prevalent in this country. * * * It has been impossible for the writer to find any possible evidence of the existence of the gid bladderworm in this country, yet in view of the importations from Europe of sheep and dogs it is difficult to believe that we are entirely free from this parasite.

In a footnote he says:

> One extremely doubtful case has been reported to us from Minnesota of its occurrence under the skin of a horse. This latter case has not been examined by the bureau, but I would suggest that *Tænia serialis* is common in America, and considering the tissue in which this parasite was found, it is not at all improbable that the Minnesota case was one of *Cœnurus serialis* (*Tænia serialis*) rather than *C. cerebralis*.

Railliet's (1893a) earlier note of this case is based on correspondence.

As this case stands we may choose between considering it as the first and only case of *C. serialis* in the horse and in its normal location, or regarding it as one of several cases of *C. cerebralis* in the horse, occurring in a location in which it has been reported twice

from the sheep. The case is too doubtful to pass judgment on, and the report may have been an error in the first place.

Wallace (1900a) diagnoses a case for a correspondent from Iowa as gid in sheep. The symptoms are suspicious, but not clearly gid.

Shaw (1901a), writing of the sheep industry of Minnesota, says that gid "has not been markedly prevalent in Minnesota." In a personal communication dated July 27, 1909, Professor Shaw writes:

> I have seen cases which I supposed to be gid in sheep, but I have never seen the parasite itself * * *. Dr. H. M. Reynolds, veterinarian of our [Minnesota] station * * * tells me that his experience is similar to mine. He has not yet seen the parasite.

The veterinary editor formerly referred to (Vet. Ed. Amer. Sheep Breeder, 1901γ and 1901δ) diagnoses a case as gid in reply to two correspondents from Montana who describe the symptoms and post-mortem findings of their sheep. The diagnosis is unmistakably correct. He states (1901δ) that gid is "fortunately not very common except in the native sheep of the plains." Strictly speaking, the only native sheep in America are the Bighorn sheep, *Ovis montana*, of the mountains, never reported as subjects of gid. The reference is perhaps to native-bred sheep. The diseased sheep in this case came from Colorado, and the editor states:

> It [*C. cerebralis*] is especially common in Colorado, where 70 per cent of sheep examined by Doctor Curtice were infested by it. It is unquestionably quite as common in all the western country from Mexico as far north as the animals mentioned [foxes, wolves, and coyotes] exist.

It has already been noted that Doctor Curtice says that he has never seen *T. cœnurus*.

Finally the editor states that he has recently operated on seven sheep for gid. This is the first record of what appears to be a clear case of the finding of the parasite in the United States. On attempting to secure further information about these cases it was learned that the veterinary editor in question was deceased.

In another sheep-breeders' periodical (Vet. Ed. Amer. Shepherd's Bulletin, 1902α) a case from Illinois is diagnosed as probably gid. The symptoms are quite characteristic—slobbering, refusal to eat, turning always to left, head held down to left, death the fourth day. The case was probably gid. The editor states that he has seen gid in England, but not in the United States, though he claims that there is reason to suppose that it occurs in imported sheep.

Law (1903a) says of the adult tapeworm from *Cœnurus cerebralis:* "The writer raised forty-two, averaging 1 foot, in six weeks in a sucking puppy." Doctor Law writes in a letter of July 2, 1909, already noted, that this was done in Edinburgh, Scotland, in 1864 or 1865, and that he has not seen gid in America.

Cases from Nevada, showing the symptoms and post-mortem evidence of gid, are so diagnosed by the veterinary editor of the American Sheep Breeder (1903α). Some cases from Kansas and Iowa, with symptoms of gid, but no post-mortem findings, are also diagnosed as gid. (Vet. Ed. Amer. Sheep Breeder, 1903β and 1903γ.)

The same year, the veterinary editor of the American Shepherd's Bulletin (1903α) states that the disease is prevalent in Utah and common in other sections. He diagnoses gid in two imported rams in Michigan (Vet. Ed. Amer. Shepherd's Bulletin, 1903β)—the diagnosis seems correct from the characteristic symptom complex—and gives the report of an operation (Vet. Ed. Amer. Shepherd's Bulletin, 1903γ) from an unspecified locality where some one found a "bag of water" on the sheep's brain.

The next year, Stiles (1904s) wrote of *Cœnurus cerebralis:* "I have never seen any specimen of this parasite collected in the United States."

The same year, an outbreak of gid occurred in Montana, a discussion of this outbreak being given the following year by Ransom (1905d). In that article Ransom states:

> Until very recently, so far as it has been possible to determine, gid has been entirely unknown in this country. * * * It seems hardly probable, in view of our present knowledge, that the disease has been altogether absent. * * * The disease is now present in the United States, cases having developed recently which, as the attendant circumstances show, must have resulted from infection in this country.

The sheep in question died at Bozeman, Mont. A comparison of the cœnuri obtained showed a complete agreement with the description of the European *Cœnurus cerebralis*. Ransom's article pointed out the danger from this disease and the means of combating it.

In addition to Ransom's cases of gid from Montana, the veterinary editor of the American Sheep Breeder (1905α-ζ) answers a number of letters from which it appears that gid was present the same year in Missouri, Kansas, Ohio, Colorado, Indian Territory, and other localities not specified. The symptoms were quite characteristic in the Missouri cases and were confirmed by post-mortem in the cases from Ohio and the Indian Territory. These cases are, in my opinion, undoubtedly gid, and the Kansas and Colorado cases are possibly gid.

Clarke (1907α) states that he has met many cases of gid in sheep at the slaughterhouses, but in a personal communication of August 2, 1909, he writes that this was in England.

Wing (1907α), after many years experience with sheep, states that he is not sure that he has ever seen an instance of gid.

Kaupp (1908α and 1910α) has overlooked the work of Ransom (1905d), as well as some other articles we have cited, and states that gid is not reported in the United States.

Luckey (1908*a*), writing from Missouri, states: "Although not very common in this State, what is known as sturdy or gid in sheep causes some loss."

Regarding this, Doctor Luckey writes, under date of July 21, 1909, that he has not kept an accurate record of outbreaks, but remembers a report from Willow Springs, Howell County, describing perfectly the symptoms of gid in goats. This is the only case known to me where gid has been reported from the goat in the United States, and it is included in a subsequent list as a probable case.

The veterinary editor of the American Sheep Breeder (1908*j*) diagnoses as gid a very doubtful case in an Iowa sheep, and elsewhere (Vet. Ed. Amer. Sheep Breeder, 1908*a*) states that the disease is very prevalent at the time in some parts of the United States.

The writer (Hall, 1909*a* and 1910*a*) has twice reported gid from the United States, once with a record of cases.

The official files of this Bureau furnish additional data, mostly obtained through inquiries by Dr. B. H. Ransom, chief of the Zoological Division of the Bureau. Dr. S. W. McClure, Bureau veterinary inspector, Pendleton, Oreg., in addition to furnishing this division with specimens of giddy sheep, further informs us under date of September 3, 1906, that a highly reliable sheep man of Chouteau, Mont., claims to have had gid among his yearlings "for many years," having 40 to 60 affected every year out of 2,000. Many other Montana sheepmen, according to Doctor McClure in a letter of October 15, 1906, claim to have the disease in their flocks. One claims to have 15 to 20 cases some years, another had over 200 cases among 10,000 lambs in 1905, another had 30 cases among 4,000 lambs in 1898, another had 15 cases among 1,500 bucks in 1906, and others had a few cases each year. Doctor McClure states that he has met sheepmen who tell him that when they recognize an animal as affected with gid they forward it to the feeding point for market if they have a shipment about that time.

Dr. R. H. Treacy of this Bureau reports under date of June 5, 1907, a list of 11 flocks in Montana where gid, shown by the presence of cysts in the brain, was reported by Doctors Stauffer, Nutting, and Cary. According to Doctor Treacy, the sheepmen have been classing the trouble as loco, poison weed, water on the brain, grubs in the head, etc., and have paid no attention to destroying the dead animals. This fact, together with the statement of Doctor Stauffer in his letter of February 25, 1908, to Doctor Treacy, that certain sheepmen would not subject their dogs to vermifuge treatment because they were using the dogs, shows a condition of affairs which must make for the spread of gid in Montana. Two other factors in the

spread of gid are mentioned by Doctor Cary in a letter to Doctor Treacy under date of April 9, 1908. One is the habit of some sheepmen picking up a dog wherever they can find one. The other is the "floater" band, or wandering band of sheep. In the latter connection he states:

> In the spring of 1907 a giddy band of "floaters" from Flatwillow country trailed along the northern boundary of the Crow Reservation, several of the lambs dying as they passed through the Blue Creek country 9 miles south of Billings, and I believe it was through this band that the Arthur Milne band in Blue Creek became affected this spring. * * * The Milne lambs were raised in the Blue Creek country, and gid has never been known there till this spring.

A discussion of the existing neglect of prophylactic measures against gid in the western part of the United States has been given by the writer in a bureau article. (See Hall, 1910*a*.)

Specimens of *Cœnurus cerebralis* from the brains of giddy sheep were collected by Professor Cooley January 5, 1904, Doctor McClure in May, 1906, Doctor Cary April 20, 1907, Doctor Davison December 21, 1907, Doctor Stauffer in January, 1908, and Doctor Peck July 11, 1908.

Doctor Stauffer also furnished a map of Chouteau County, Mont., showing the distribution of gid in that county. Doctor Treacy has prepared a map of the State of Montana showing the distribution of gid in that State during the spring of 1908. From these maps, from correspondence, and from information obtained during a personal investigation of gid in Montana during the spring of 1910, the map given here as figure 1 has been compiled. The infected areas shown by Doctor Treacy are indicated by solid blocks. Other infected areas where gid has occurred at some time during the period from 1898 to 1910, inclusive, are indicated by hollow blocks. The area where the continued recurrence of gid shows that the range is infected is indicated by shading. This area is 400 miles long and in places is 200 miles wide. During the personal investigation referred to above, evidence was obtained showing that cases of gid occurring outside of the infected area indicated on the map had probably been imported from the infected area. It will be seen from the map that gid has occurred in Teton, Chouteau, Valley, Cascade, Fergus, Gallatin, and Yellowstone counties. The first four and probably northern Dawson are infected ranges.

Montana's 5,747,000 sheep, representing, according to the Bureau of Statistics [a] of the United States Department of Agriculture, a value of $24,137,000 on January 1, 1910, are threatened by the presence of a disease which has become enzootic over a large part of the

[a] Crop Reporter, U. S. Department of Agriculture, vol. 12, no. 2, February, 1910.

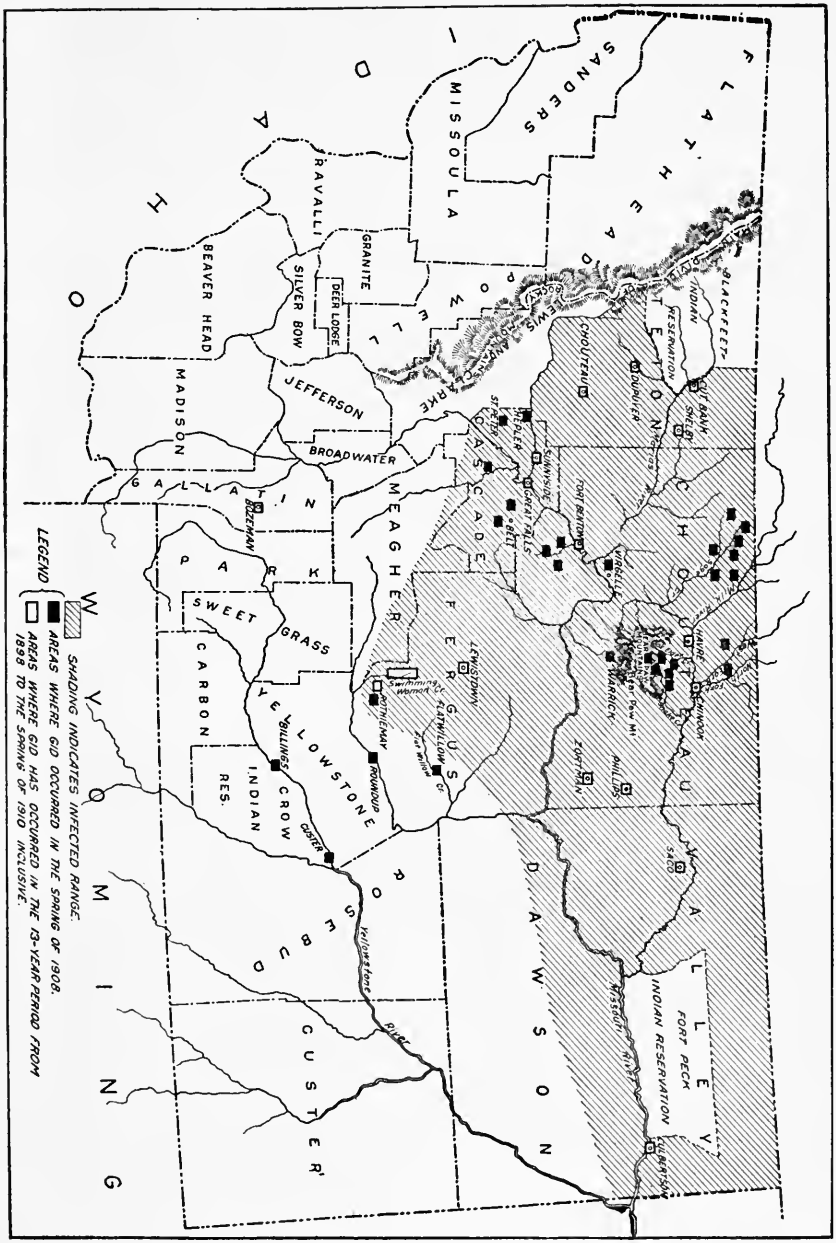

Fig. 1.—Map of Montana, showing distribution of gid in sheep.

State, and which in recent years has exacted toll in increasing amounts from the flocks. Such a condition necessarily exposes the flocks of neighboring States to the danger of infection carried from Montana by dogs or possibly by wild carnivora or in shipments of sheep. In view of the unsuccessful efforts of European countries to eradicate gid in over half a century of educated effort, and in view of the increase and spread of the disease in Montana in the last decade, it is to be hoped that the importance of attempting the eradication of this disease will soon be realized.

The first authentic instance of gid in the eastern United States occurred in 1909, and the first account of it was given by Doctor Law in a paper read before the New York State Veterinary Medical Society in August, 1909. The outbreak was reported by Taylor and Boynton (1910a), who found it in a flock of sheep about 40 miles from Ithaca. They discovered the gid parasite in the brain and claim to have raised one specimen of the adult tapeworm in a dog by feeding a cœnurus to it. They believed that they found the source of the disease in two collies imported from Scotland to the farm where the disease occurred. The adult parasite was apparently not sought for in the dogs. In a footnote they state that Dr. Charles Linch investigated an outbreak of disease among sheep in New York in the spring of 1909 and reported that it was gid, but did not report finding the parasite.

Melvin (1910α) has called attention to the fact that Taylor and Boynton have overlooked a number of articles when they state:

> In a careful search of the literature we have failed to find any authentic report of a positively identified case of the disease having appeared in the United States.

Subsequently, Taylor and Boynton (1910β) have modified this statement, making it refer only to New York State.

The occurrence of certain, probable, and doubtful cases of gid in the United States is indicated in the following tabular statement.

List of occurrences of Multiceps multiceps recorded from the United States.

Locality.	Author.	Date.	Notes and comments.
New York (?)	Livingston	1809*a*	Three cases; probably meningitis, not gid.
United States (?)	Leidy	1856a and b	Parasite observed; place not stated.
Do	McClure	1870*a*	Do.
United States	Verrill	1870d	States that gid occurs in United States.
New York and elsewhere.	Tellor	1879a	Do.
Tennessee	Crutchfield	1880*a*	Claims to have lost sheep from gid; no symptoms or post-mortem records.
United States	Stewart	1880a	States that gid occurs in United States.
Eastern United States	Powers	1887*a*	Claims to have cured, but not seen gid.
United States	Curtice	1890c	States that gid occurs in United States.
Colorado	do	1892g	Adult from dog; Curtice doubts correctness; I find it incorrect.
United States	Veterinary editor, American Sheep Breeder.	1895*a*	Imported Shropshire; symptoms and post-mortem indicate gid.
Do	do	1895*β*	One case; characteristic symptoms.
Nebraska	Ward	1896b	Adult from dog; Stiles (1898a), on examination, makes this *T. serialis*. Accepted by Ward (1897b) from correspondence.
United States	Veterinary editor, American Sheep Breeder.	1897*β*	One case; characteristic symptoms.
Montana	Knowles	1897*a*	Notes inquiries in regard to gid. Dr. Knowles saw cases in 1897.
Minnesota	Stiles	1898a	One case in horse under skin; Stiles thinks this may be *C. serialis;* doubtful; case previously noted by Railliet (1893a) from correspondence.
Iowa	Wallace	1900a	One case; symptoms not characteristic.
Minnesota	Shaw	1901a	States that gid occurs in United States.
Montana	Veterinary editor, American Sheep Breeder.	1901*γ* and *δ*	Several cases; symptoms and post-mortem show gid unmistakably.
Colorado	do	1901*δ*	States that gid occurs in United States; Curtice wrongly quoted as authority.
United States	do	1901*δ*	Seven cases operated on by author.
Illinois	Veterinary editor, American Shepherd's Bulletin.	1902*a*	One case; characteristic symptoms.
Nevada	Veterinary editor, American Sheep Breeder.	1903*a*	Several cases; symptoms and post-mortem show gid unmistakably.
Kansas	do	1903*β*	Several cases; characteristic symptoms.
Iowa	do	1903*γ*	One case; characteristic symptoms.
Utah and elsewhere	Veterinary editor, American Shepherd's Bulletin.	1903*a*	States that gid occurs in United States.
Michigan	do	1903*β*	Two imported rams; characteristic symptoms.
United States	do	1903*γ*	One case; "bag of water" on brain.
Montana	Ransom	1905d	Several cases in 1904; parasite found and studied.
Missouri	Veterinary editor, American Sheep Breeder.	1905*a*	Several cases; characteristic symptoms.
Kansas	do	1905*β*	Several cases; symptoms not characteristic.
Ohio	do	1905*γ*	Two cases; symptoms and post-mortems show gid; had lost sheep thus before.
Colorado	do	1905*δ*	Few cases; symptoms not characteristic.
United States	do	1905*ε*	States that gid occurs in United States; in answer to some letters.
Indian Territory	do	1905*ζ*	Several cases; symptoms and post-mortems show gid.
Missouri	Luckey	1908*a*	States that gid occurs in United States.
United States	Veterinary editor, American Sheep Breeder.	1908*a*	Do.
Iowa	do	1908*β*	One case; symptoms not characteristic.
Montana and Washington, D. C.	Hall	1909*a*	Two natural and one experimental infections; first record in this country of adult worm produced by feeding larva.
New York	Taylor and Boynton.	1910*a*	Several cases; symptoms and post-mortem show gid.
Montana	Hall	1910*β*	This article.

The following list of cases occurring in the United States and not previously recorded is compiled from correspondence as given:

List of occurrences of Multiceps multiceps in the United States recorded here for the first time.

Locality.	Letter.	Notes and dates.
Shelby, Mont.	Dr. McClure to Dr. Melvin, July 18, 1906.	Sun River Land and Live Stock Co.; 250 out of 10,000; 1906; 1 case shipped to Washington, D. C., died en route.
Chouteau County, Mont.	Dr. McClure to Dr. Melvin, Sept. 3, 1906.	Cowell flock; 40 to 60 out of 2,000; many years.
Do.	Dr. McClure to Dr. Melvin, Oct. 15, 1906.	Cowell flock; 15 to 30 cases; almost every year.
Do.	....do....	McDonald flock; 15 to 20 cases some years.
Sunnyside, Cascade County, Mont.	....do....	Sun River Land and Live Stock Co.; 200 out of 10,000; 1905.
Zortman, Chouteau County, Mont.	....do....	Whitcomb flock; 30 out of 4,000; 1898.
Phillips, Mont.	....do....	Phillips flock; 15 out of 15,000; 1906.
Ohio	Dr. Ransom to Dr. McClure, Oct. 24, 1906.	Rambouillet sheepmen claim to have had several cases in imported and at least one case in native sheep.
Montana	Dr. McClure to Dr. Melvin, Dec. 5, 1906.	Phillips flock; 2 or 3 at date of writing.
Rothlemay, Mont.	Dr. Cary to Dr. Treacy, Apr. 20, 1907.	Pirrie flock; 250 to 300; 1907; parasite found in 3 of 4 examined.
Chouteau, Mont.	Dr. Nutting to Dr. Treacy, April, 1907.	McDonald flock; 125 dead at date of writing.
Flatwillow country, Fergus County, Mont.	Dr. Cary to Dr. Treacy, May 21, 1907.	Infected country; 1907.
Swimming Woman country, Fergus County, Mont.	....do....	Do.
Yellowstone County, Mont.	....do....	Sheep from Flatwillow country and probably infected there.
Chinook, Mont.	Dr. McClure to Dr. Melvin, June 5, 1907.	In Blackwood, Taylor, Sprinkle, Sprinkle Bros., and McCann flocks; 1907; reported by Dr. Stauffer.
Saco, Mont.	....do....	Rieder flock; 1907; reported by Dr. Stauffer.
Cut Bank, Mont.	....do....	Town flock; 1907; reported by Dr. Stauffer.
Chouteau County, Mont.	....do....	McDonald flock; 1907; reported by Dr. Nutting.
Dupuyer, Mont.	....do....	Leech flock; 1907; reported by Dr. Nutting.
Huntley, Mont.	....do....	Green flock; 1907; reported by Dr. Cary.
Rothlemay, Mont.	....do....	Pirrie flock; 1907; reported by Dr. Cary.
South Dakota	Dr. Ransom to Dr. Hickman, July 2, 1907.	One case in imported ram.
Teton County, Mont.	Dr. Davison to Dr. Melvin, Dec. 21, 1907.	McDonald flock; several cases at date of writing; parasite found; 10 per cent lost the winter before.
Sage Creek, Mont.	Dr. Stauffer to Dr. Treacy, Feb. 25, 1908.	Sprague and Lavid flocks; 1908.
Bear Paw Mountains, Mont.	....do....	L. Sprinkle, C. Sprinkle, and Taylor flocks; 1907 and 1908.
Benton, Mont.	....do....	Northwestern Live Stock Co.; 1908.
Virgelle, Mont.	....do....	Blankenbaker flock; 1908.
Chinook, Mont.	....do....	One case; 1907.
Billings, Mont.	Roy Stebbins to Dr. Melvin, Feb. 27, 1908.	Ewes affected; not clearly gid.
Swimming Woman country, Flatwillow country, Musselshell country, Custer Station, and Blue Creek country.	Dr. Cary to Dr. Treacy, Apr. 9, 1908.	Most of these giddy bands seem to have originated in the Flatwillow country.
Conrad, Mont.	Dr. Peck to Dr. Melvin, July 8, 1908.	One sheep shipped to Washington, D. C.
Fort Benton, Mont.	Dr. Peck to Dr. Melvin, July 13, 1908.	Parasite forwarded to Washington, D. C.
Gildford, Chouteau County, Mont.	Dr. Stauffer to Dr. Melvin, Feb. 5, 1909.	Two sheep shipped to Washington, D. C.
Willow Springs, Mo.	Dr. Luckey to the writer, July 21, 1909.	Symptoms of gid in goats; date not given.
Waverly, Iowa	Dr. McHenry to Dr. Melvin, June 14, 1910.	Two cases, one showing cyst on post-mortem examination.

Some discrepancies will be noted in the above figures. No attempt has been made to ascertain which are correct. Dates of occurrences must also be taken with some regard for the fact that

a record of gid by one or more observers as occurring in two consecutive years may not necessarily be a record of two outbreaks but merely a record of one outbreak running through the winter of one year into the spring of the following year.

Giddy sheep have been sent in to this laboratory from Montana on four occasions, two sheep being sent in May, 1907; one in July, 1908; two, already noted as recorded by Hall (1909α), in February, 1909; and one in May, 1910. In an earlier shipment in July, 1906, the one sheep sent died en route.

Both the adult and larval *Multiceps multiceps* have been produced in this laboratory at Washington, D. C., and at Bethesda, Md., by feeding experiments in cases other than those noted by Hall (1909α) in an earlier paper.

From the foregoing it seems certain that the gid parasite was observed in this country at least as early as 1901. It does not seem likely that the many claims made for its occurrence earlier than this are entirely unfounded. During an investigation of gid in Montana in the spring of 1910, the writer met a number of sheepmen who claimed to have had their first losses from gid some time between the years 1885 and 1890. These men have been acquainted with the disease ever since and still have it in their flocks, so that there is no reasonable doubt as to gid having occurred in this country previous to 1890. Certainly it now has a foothold in this country.

GID IN CANADA.

The presence of gid in either the United States or in Canada must necessarily be of interest to the other of the two countries, owing to the possibility of the disease being carried across the border by dogs or wild carnivora or in shipments of sheep. In the course of a correspondence with this Bureau relative to gid, Dr. J. G. Rutherford, the veterinary director-general of Canada, undertook to find out whether gid had been imported into Canada by making inquiry of sheep breeders and dealers. From a synoptical statement of the replies made by thirteen dealers it appears that eleven have never seen the disease in their flocks, and Doctor Rutherford himself states, in a letter of October 8, 1909:

> During many years' practice, I have, personally, never seen the disease in Canada, although I was quite familiar with it in Scotland when a young man. I have never heard the disease mentioned by Canadian veterinarians, although, as you are aware, this is no proof of its nonexistence in the country, as the members of our profession are seldom called upon to treat sheep.

Of the two dealers who had seen the disease, F. H. Neil, of Lucan, Ontario, "has had no trouble with gid parasite for a number of years. Has seen some flocks affected in both Canada and the United States, but does not specify where."

The other dealer, J. H. Patrick, of Ilderton, Ontario, "has had no trouble with this parasite the last few years; previously when importing sheep in large numbers experienced considerable loss, which he attributed to this cause."

From a scientific standpoint, the data given above do not justify a positive record of the gid parasite from Canada, and if the disease exists there at all it seems from the above evidence to be comparatively unimportant. At the same time, the presence of gid in northern Montana would constitute a ready source of infection for sheep in Canadian territory.

THE HOSTS AND OCCURRENCES OF THE LARVAL MULTICEPS MULTICEPS.

In compiling the following list of hosts, an attempt has been made to put them on an objective basis so far as possible. A list of certain or probable hosts has been compiled for those cases where *Multiceps multiceps*, or what appears to have been *M. multiceps*, has been found at least once in the host in question. A list of erroneous records has been compiled for cases where there is certainly an error in the record or in the finding. A third list of doubtful forms seems to be the only proper place for cases where the evidence is inadequate for the acceptance or rejection of the record.

In the first list given below, only those records of occurrences in sheep and cattle which are of historic interest or which show geographic or time distribution are given, as the former are the usual and the latter the very common hosts of the parasite. In the other cases there are included only those where the presence of a cœnurus has been shown at least once for that host, assuming it as probable from the evidence at hand that the cœnurus in question was *Multiceps multiceps*.

List of certain or probable occurrences of the larval Multiceps multiceps.

Host.	Locality.	Authority.	Notes and comments.
Sheep	Greece	Hippocrates 1825*a*	Probable cases 460–375 B. C.
Goat	do	do	Do.
Sheep	Germany	Rolfinck 1656a	
Do	Switzerland	Wepfer 1658*a*	
Cattle	do	do	
Sheep	Germany	Scultetus 1672a	Date of first certain case 1634.
Cattle	Germany (?)	Brunner 1694*a*	According to Küchenmeister (1880a).
Do	"Berovia"	Wepfer 1724*a*	
	"Gurtwillae"		
Sheep	Germany	Leske 1780a	First recognized as a cestode parasite.
Do	do	Goeze 1780a	Independently recognized as a parasite.
Do	Italy	Fontana 1784a	
Cattle	do	do	
Sheep	Germany	Schrank 1788a	
Cattle	do	do	
Chamois	Alps	Retzius 1790a	At least one case.
Sheep	England	Moorcroft 1792a	Claimed to occur in France and Italy also.
Cattle	do	do	
African antelope	Not given	Rudolphi 1808a	Accepted here on basis of subsequent findings.

List of certain or probable occurrences of the larval Multiceps multiceps—Continued.

Host.	Locality.	Authority.	Notes and comments.
Sheep	France	Bosc 1810a	
Horse	(?)	Bousset 1822*a*	According to Gurlt (1831a).
Do	(?)	Hofacker 1823*a*	According to Numan (1850b).
Chamois	Paris, France	De Blainville 1824a	
Sheep	France	Yvart 1827*a*	First record from spinal canal, according to Braun (1894a).
Do	do	Dupuy 1831a	From spinal canal.
Horse	(?)	Frenzel(Date?)	According to Gurlt (1831a) and Numan (1850b).
Do	England	Youatt 1834b	"Hydatid" in septum lucidum; symptoms given.
St. Domingo goat	do	Youatt 1836c	"Hydatid" considered here as cœnurus on basis of subsequent findings.
Sheep	Germany	Pluskal 1844*a*	Indefinite number of spinal cases.
Do	Austria	do	
Do	Ireland	Bellingham 1844a	
Goat	Germany	Klencke 1844a	
Mouflon	Montpelier, France	Gervais 1847b	One case.
Horse	(?)	Ammon(?)	According to Numan (1850b).
Sheep	(?)	Störig(Date?)	Found it twice in the medulla oblongata, according to Numan (1850b).
Do	Holland	Numan 1850b	Among others, one had cœnurus in cerebrum, medulla oblongata, and in spinal cord.
Angora goat	do	do	Cœnurus is figured.
Cattle	Kempton, [Bavaria?].	Hering 1852a	Occurred in 1850–51.
Sheep	Germany	Hagmaier 1853a	In spinal canal.
Antelope	(?)	Jacques and Lafosse 1854b.	
Goat	(?)	do	
Sheep	Scotland	McCall 1857a	
Do	France	Reynal 1857a	
Cattle	do	do	
Sheep	Alfort, France	Valenciennes 1857a	In spinal cord and brain; sent by Delafond.
Horse	Vienna, Austria	Spinola 1858b	In spinal cord; specimen in veterinary school.
Sheep	Germany	do	In spinal cord.
Goat	Toulouse, France	Baillet 1859b	One certain and 1 possible infection of 4 experiment animals.
Gazelle	do	do	
Sheep	Warschau	Leisering 1859a	Eichler's subcutaneous specimen; found to be cœnurus by Eichler, Leisering, and Zenker.
Do	Germany	Leisering 1862a	Von Nathusius' subcutaneous specimen; Eichler's specimen noted again.
Gazelle (*Antilope dorcas*).	do	do	One case in a zoological park.
Horse	Prussia	Esse et al. 1863*a*; Keiper et al. 1864.*a*	One case; accepted on symptoms and in view of other cases.
Sheep	Iceland	Krabbe 1864h	Disease often seen here; accepted on Krabbe's finding of adult worm in dogs.
Cattle	do	do	Rare; accepted as above.
Sheep	Denmark	do	Claimed to occur; accepted as above.
Cattle	do	do	Do.
Do	England	Cooper 1865a	Three cases.
Chamois	Germany	Frauenfeld 1868a	Do.
Sheep	Vienna, Austria	Bénion 1874a	Several spinal cases seen by Röll.
Sheep	Germany	Müller 1877a	One case with cœnurus in spinal cord; 1 in medulla oblongata.
Antelope (*Bubalis sp.*).	Lyon, France	Bertolus and Chauveau 1879a.	Host from Africa.
Sheep	South Australia	Dixon 1883*a*	
Do	Sardinia	Parona 1884a	
Horse	Culm, Germany	Schwanefeld 1885a	Contained one-sixteenth of a liter of fluid.
Sheep	Buenos Ayres, Argentine Republic.	Wernicke 1886*a*	
Hippotragus equinus (?).	Germany	Rabe 1889a	Host from South Africa; in brain, thyroid, lymph glands, and musculature.
Sheep	Montana, U. S.	Vet. Ed. Amer. Sheep Breeder 1901*f* and *g*.	Accepted on symptoms and post-mortem findings.
Do	New Zealand	Gilruth 1902*a*	
Goat	Cape Colony	Buckley 1904*a*	Several cases; accepted on symptoms and post-mortem findings.
Cow	do	Robinson 1905a	One case.

List of certain or probable occurrences of the larval Multiceps multiceps—Continued.

Host.	Locality.	Authority.	Notes and comments.
Cattle	Francc	Leblanc and Freger 1907*a*.	One case.
Chamois	Germany	Roth 1907c	Do.
Cattle	England	Pollock 1908*a*	
Horse	Shetland	White 1909*a*	One case; symptoms of gid and recovery of parasite by operation.
Cow	Germany	Pfab 1909*a*	The only record found of the parasite from the vertebral canal in this host.
Sheep	England	Lloyd 1909*a*	
Cattle	Italy	Vicariotto 1909a	
Sheep	Montana and Washington, D. C.	Hall 1909*a*	
Goat	Missouri, U. S.	Doctor Luckey in letter of July 21, 1909.	From personal correspondence with Doctor Luckey already noted.
Cow	Germany	Borstelmann 1910*a*	Bladderworm the size of pigeon egg in medulla oblongata; probably *M. multiceps* from size and location.
Cattle	.....do	Pfab 1910*a*	Fifty-eight operations from 1903 to 1909, inclusive; additional cysts found in the medulla oblongata in 3 cases.
Sheep	German Southwest Africa.	Scheben 1910*a*	

A reference by title only to an article by Gough (1909*a*) on "A Cœnurus in the Duiker" can not be verified at this time, as the article is not yet available. The article is referred to here on the likelihood of a cœnurus from the duiker antelope being the gid parasite.

In the foregoing list the sheep, cow, goat, horse, chamois, mouflon, gazelle, and some antelope forms—given as antelope, African antelope, *Bubalis sp.* and *Hippotragus equinus* (?)—are accepted as hosts of *Multiceps multiceps*.

The parasite is recorded from sheep in Greece, Germany, Switzerland, England, France, Italy, Ireland, Holland, Scotland, Austria, Denmark, Iceland, Argentine Republic, Sardinia, South Australia, New Zealand, German Southwest Africa, and the United States. Its presence is claimed or implied, by local names for gid or otherwise, in Hungary by Küchenmeister (1853e) and Cobbold (1867o), in Cape Colony by Hellier (1894a) and Hutcheon (1904*a*), in Chile and Spain by Monfallet (1899a), and in Shetland by White (1909*a*).

It is recorded from cattle in Switzerland, Germany, England, Italy, France, Iceland, Denmark, and Cape Colony.

It is recorded and figured from the goat in Holland by Numan (1850b); it was experimentally produced in this host in France at least once and possibly twice by Baillet (1859b); the characteristic symptoms and post-mortem findings are recorded for several cases in Cape Colony by Buckley (1904*a*); and on the strength of these records the following have been accepted: Jacques and Lafosse's (1854b) case, Youatt's (1836*a*) "hydatid" from the brain of a goat with symptoms of gid, Klencke's (1844a) record from Germany, Hippocrates's (1825*a*) necessarily uncertain record from Greece, and Doctor Luckey's cases recorded here from the United States. Klencke claims to have produced the cœnurus by an absurd inoculation experiment, but this host record may be accepted in view of the possibility that he inoculated a goat already infected with gid.

Doctor Luckey's cases are accepted on the objective grounds that the cases seemed to be gid and that the parasite is known from that host and has been found in this country. Baillet (1859b) says that gid has often been seen in goats by veterinarians, but does not add any particulars.

Spinola (1858b) states that the veterinary school at Vienna had a specimen of the gid parasite taken from the spinal cord of a horse. Esse and his associates (1863α) and Keiper and his associates (1863α and 1864α) found a parasite in the brain of a horse in Prussia, and on the strength of the symptoms concluded that it was a cœnurus, but they apparently did not study the parasite to see what it was. Schwanefeld (1885a) states that he found a cœnurus containing one-sixteenth of a liter of fluid in the brain of a horse in Germany. Youatt (1834β) saw a horse that showed symptoms of staggering; post-mortem examination disclosed a "hydatid" in the septum lucidum. White (1909a) operated on a horse that showed symptoms of gid and extracted a cyst from the brain. On the combined evidence the above cases are accepted, as well as those of Ammon, Bousset, Frenzel, and Hofacker as given by Gurlt (1831a) and Numan (1850b), which cases are covered in articles not at present available.

Multiceps multiceps is recorded from the chamois in Switzerland by Retzius (1790a), in France by De Blainville (1824a), in three cases in Germany by Frauenfeld (1868a), and in one case by Roth (1907c), a total of six cases. Frauenfeld also states that the royal head forester had noted several cases of gid in the chamois and that the disease is well known to old chamois hunters.

The parasite has been found in the gazelle in France by Baillet (1859b) and in Germany by Leisering (1862a).

It has been found in the antelope by Jacques and Lafosse (1854b), in *Hippotragus equinus* (?) by Rabe (1889a), in *Bubalis sp.* by Bertolus and Chauveau (1879a), and in an African antelope by Rudolphi (1808a).

In Rabe's case the host had only been in Germany fourteen days after its arrival from Africa, and Leisering's host animal was from a zoological park; the host noted by Bertolus and Chauveau had been shipped from Africa to France, and Rudolphi's antelope is specified as African. Gough's (1909α) cœnurus, alluded to on page 32 is another case of a cœnurus in an African antelope. These facts seem to indicate that the gid parasite is not uncommon among the Bovidæ of Africa. Nor is this an unreasonable supposition. Varieties of native sheep and species of antelope are so distributed throughout Asia, Africa, and Europe that there is practically no break in the geographic distribution of host species between the European countries known to be infected and the Cape of Good Hope, where it appears from the records of Hellier (1894a), Buckley (1904α), Robinson (1905a), and Robertson (1908α) that the disease also

exists. The transmission of the parasite across this area, if indeed it was not originally distributed from Egypt, or the valley of the Euphrates, would be a simple matter for the flocks of nomadic shepherds or individual hosts of the adult or larval parasite. Scheben (1910*a*) states that gid is a trouble of long standing in German Southwest Africa. The increasing interest in the parasite fauna of Africa ought to result in additional light being thrown on this subject.

Multiceps multiceps has been recorded once from the mouflon in France by Gervais (1847b). Schrank's (1788a) statement that it occurs in the mouflon is without any record of authority or of personal observation.

The above list shows records of the occurrence of *Multiceps multiceps* more than eight times in the spinal cord of sheep, in one case with a simultaneous infection of the brain, and in one case with simultaneous infection of the brain and medulla oblongata. The parasite is twice recorded from the medulla oblongata alone in the sheep with a total of three cases. It must be much more common in these locations than records of cases show, as Frenzel (1794a) stated over a century ago that the parasite occurs in the brain, medulla oblongata, and spinal cord. It is recorded from the subcutaneous tissue of the sheep twice, from the spinal cord of the horse once, from the spinal cord of the cow once, from the medulla oblongata of the cow four times, and from the brain, thyroid, lymph glands, and musculature of the gazelle once.

If from the above list of certain and probable occurrences there were selected those cases where it is certain that the parasite was *Multiceps multiceps*, on the basis of description, figures, and feeding experiments, the certain hosts would be limited to the sheep, cow, and goat.

In the following list are shown those cases where a record is based on data which I regard as inadequate, or where the author himself has considered the case doubtful, or where both these things are true:

List of doubtful cases of the occurrence of the larval Multiceps multiceps.

Host.	Locality.	Authority.	Notes and comments.
Reindeer (*Cervus tarandus*).	Lapland	Hoffberg 1759a	Symptoms resemble gid; so accepted by Braun (1894a).
Giraffe (*Camelopardalis giraffa*).	Not given	Rudolphi 1804a, 1810a.	
Horse	do	Rudolphi 1808a	Statement that hydatids are rare in the brain of the horse.
Do	do	Gurlt 1831a	Brain and spinal cord.
Roe deer (*Cervus capreolus*).	do	Barthelemy 1839*a*	Mere statement; accepted by Diesing (1850a).
Sheep	Germany	Jacobi 1882*a*	Entire flock afflicted with spinal gid.
Pig	Finland	Kolster 1893a	In heart.
Horse	United States	Stiles 1898a	Subcutaneous.
Dog	Italy	Guerrini 1909*a*	Given in list of museum specimens.

The above list shows that it is doubtful whether the reindeer, giraffe, roe deer, pig, and dog can be considered as hosts of *Multiceps multiceps*.

In the historical sketch (p. 10) the necessity for considering the reindeer a doubtful host of *Multiceps multiceps* has already been shown. It is true that Diesing (1850a) lists the parasite from this host, crediting the observation to Retzius, but as a matter of fact Retzius (1790a) lists the parasite from *Capra rupicapra*, the chamois, and not from the reindeer.

Rudolphi (1804a) states that in conversation with Le Vaillant, the latter told him that he had found worms in the brain of the gazelle and the giraffe. Later, Rudolphi (1810a) lists these as "*?Cœnurus cerebralis*" from the gazelle, and "*?Cœnurus*" from *Camelopardalis giraffa*, showing that he himself felt very doubtful of this last case. In view of the fact that no one has previously or since recorded a cœnurus from this host, and that Rudolphi (1819a) later omits the giraffe from his list of hosts of this parasite, and in view of the fact that the giraffe's habit of feeding largely on high-growing foliage renders it little likely to have its food contaminated by the feces of the known hosts of the adult *Multiceps multiceps*, we must consider this record of Le Vaillant's finding very doubtful.

Rudolphi's (1808a) bare statement that hydatids in the brain of the horse were rare, together with his failure to list his *Cœnurus cerebralis* from this host in his later work of 1810, leaves it extremely doubtful whether he knew of any cases of the occurrence of *C. cerebralis* in this host.

Gurlt (1831a), in a list of hosts of *Multiceps multiceps*, lists it from the horse, specifying the brain and spinal cord as locations. As he gives no record of cases and no authority for this statement, it seems likely that he was reasoning the possibility of this from the occurrence of the parasite in both locations in the sheep.

The acceptance of the roe deer, *Cervus capreolus*, as a host of *Multiceps multiceps* by Diesing (1850a) and by subsequent writers is based by Diesing and by such writers as take the trouble to cite an authority on Barthelemy (1839α). Barthelemy states that gid occurs in sheep, in the roe deer, and in other animals. He does not claim to have seen the parasite in the roe deer, nor does he cite any one who has, hence his statement, though very plausible, is not convincing, and this record must also be held doubtful.

According to Jacobi (1882α), in a flock of 400 yearling lambs, 186 died with cœnuri in various parts of the spinal cord, but no cœnuri were found in the brain. The correctness of this statement seems questionable. That cœnuri should be found in the spinal cord in a great number of sheep would be surprising; that none should be found in the brain at the same time is scarcely to be believed. Possibly the disease in question was hydro-rhachitis and serum accumulations in various parts of the cord were mistaken for cœnuri.

Kolster (1893a) found several vesicles, each having several heads, under the pericardium of a pig. He could not decide whether it was

the larva of *Tænia cœnurus* or of some other *Tænia* having a cœnurus larva. I consider this case extremely doubtful. If *Multiceps multiceps* could develop in the pig, it seems likely that it would not be altogether uncommon, and hence would have been reported heretofore. Furthermore, the location is an unlikely one for this parasite. As the specimen in question does not seem to have had the study necessary for an identification, we are compelled to include the pig among the doubtful hosts of *Multiceps multiceps*.

In discussing gid in the United States, we have already considered Stiles's (1898a) record of subcutaneous cœnurus in the horse.

Guerrini (1909α), in a list of the parasite specimens in the collection of the veterinary college at Bologna, lists *Cœnurus cerebralis* Rud. from *Bos taurus* (meninges) and *Canis familiaris* (meninges). The adult worm, *Tænia cœnurus* Küchenm., is also listed from *Canis familiaris* (intestinum). Such a record of *Cœnurus cerebralis* from the meninges of the dog must necessarily be looked upon with doubt. When an extremely unusual or unlikely thing is recorded, the acceptance of the record must depend upon the evidence. The reliability of the collector, the accuracy of the person identifying the specimen, the features on which the identification was made, and the validity of the label, are all matters which should be made known. No evidence is furnished in this case, and hence the record of such a parasite in the dog can not be accepted without reservation.

In the opinion of the writer all records of the giraffe, the roe deer, the pig, and the dog as hosts of the larval *Multiceps multiceps* should be thrown out, as they are all probably erroneous.

The following list includes those cases where the records show undoubted errors.

List of the erroneous records of the occurrence of the larval Multiceps multiceps.

Host.	Locality.	Authority.	Notes and comments.
Man	Not given	Rolfinck 1656a	
Dog	England	Moorcroft 1792a	
Rabbit (?)	Not given	Lænnec 1804a	
Rabbit	do	Cloquet 1818a	
Do	France	Leblond 1837a	
Man	Germany	Klencke 1844a	Claims to have seen a case.
Dog	do	do	Produced by injection of rotten cœnurus in veins.
Rabbit	do	do	Produced by inoculation of rotten cœnurus on brain.
Cat	do	Numan 1850b	Misprint or based on mistranslation.
Camel	Not given	do	Based on Aran (1841a).
Reindeer (*Cervus tarandus*).	do	Diesing 1850a	Based on Retzius (1790a).
Camel (*Camelus dromedarius*).	do	Diesing 1850a et al	Based on De Blainville (1824a).
Rabbit	do	do	Based on Leblond (1837a).
"Ex *Ipalacis capensis*."	Port Natal	do	
Pig	Not given	Veterinarian 1855a	
Cow	do	Fuchs 1859a	In spinal cord.
Spalax capensis	Port Natal	Diesing 1864a	
Cow	Not given	Pagenstecher 1877a	Von Nathusius's subcutaneous specimen from sheep erroneously listed.
Do	do	Von Linstow 1878a	Subcutaneous; error as above.
Do	do	Monicz 1880a	Do.

List of the erroneous records of the occurrence of the larval Multiceps multiceps—Cont'd.

Host.	Locality.	Authority.	Notes and comments.
Cow	Not given	Leuckart 1886d	Same error as Pagenstecher (1877a) above.
Goose	do	Neumann 1888a	Based on Hering (1861a).
Cow	do	Railliet 1893a	Same error as Pagenstecher (1877a) above.
Horse	Germany	do	In eye; based on Heincke (1882a).
Sanbur (*Cervus unicolor*).	Not given	Hassall 1898a	In list.
Cow	do	Vaullegeard 1901a	In eye.
Antelope	do	do	Do.
Camel	do	Espejo y Del Rosal 1905β.	Based on Lafosse.

The weight of evidence indicates that there are no certain, probable, or reasonably doubtful cases of the occurrence of *Multiceps multiceps* in the larval state in man, the cat, rabbit, camel, sanbur, goose, or the hypothetical "*Ipalax capensis.*" It is also reasonably certain that Moorcroft (1792a) and Klencke (1844a) have erred in recording *Cœnurus* from the dog; that Retzius did not find a cœnurus in *Cervus tarandus*, as Diesing (1850a) credits him with doing; that the record of *Multiceps multiceps* from the spinal cord of the cow given by Fuchs (1859a) is not based on an actual case; that *M. multiceps* has not been found in a subcutaneous location in the same host as Pagenstecher (1877a), Von Linstow (1878a), Moniez (1880a), Leuckart (1886d), and Railliet (1893a) give it; that Heincke's (1882a) parasite from the eye of the horse was not a cœnurus as Railliet (1893a) states, and that *M. multiceps* is not known from the eye of the cow and of the antelope, as Vaullegeard (1901a) states.

Rolfinck (1856a) refers to a vertigo caused by vesicles full of water and serous humor in the brain of sheep and of man. Undoubtedly he refers to gid and its parasite in sheep, but the vertigo referred to in man has been found to be due to *Cysticercus cellulosæ* and *Echinococcus granulosus* in those cases where the most competent scientists have investigated the parasite. Klencke's (1844a) statement that he has seen a cœnurus in the brain of man does not of itself give sufficient data on which to reject the finding, but a study of Klencke's work, in which he claims to have repeatedly produced cœnurus in various hosts by inoculation of cœnurus particles, shows that his statements are not reliable, and for this reason his quite improbable claim of the occurrence of cœnurus in man is thrown out. Gervais and van Beneden (1859b) have stated that Klencke's statements do not merit confidence.

In his nomenclature of diseases of man, Bertillon (1903α) lists *Cœnure* under diseases of the digestive tract, and the Commission Internationale (1909α), in its revision of the same work, has retained this listing. As the records indicate, there are probably no cases of cœnurus in man. Whether such cases have occurred or not,

there are no good grounds for listing cœnurus or cysticercus as intestinal parasites, as Bertillon and the commission have done.

Moorcroft (1792a) states that anatomists and, to a still greater extent, butchers and shepherds, have long known of collections of colorless fluid in thin capsules in the brain of sheep and cows, and adds: "They have been met with in dogs."

The larval cestodes of dogs include, according to various authors, *Cysticercus* and *Echinococcus*. Von Linstow (1889a) lists a *Cœnurus sp.* from the dog, attributing it to Pagenstecher, but Pagenstecher (1877a), in the reference cited, refers to a growth on the neck of *Myopotamus coypus*, which he says might have been a growth of a cystoid or colloid nature such as is found in dogs, but which he finds to be a cœnurus. Klencke (1844a) claims to have produced a cœnurus in the dog by injecting rotten cœnurus into its veins, a claim so absurd as to at once discredit his findings. Guerrini's (1909α) record of a museum specimen has already been mentioned as doubtful. There are, therefore, no adequate and reliable references to a cœnurus from the dog, and as it is on the face of it highly improbable that the larval *Multiceps multiceps* would occur in the dog, we may throw out Moorcroft's casual reference.

Lænnec (1804a) states that the gid parasite occurs in the sheep, the cow, and perhaps in the rabbit. The last host is included on the basis of hunters' statements that they have seen gid in rabbits. Moniez (1880a) says he has seen such a case of gid in the rabbit, but it was not due to a cœnurus, and Lænnec admits that no one had ever seen the parasite in such cases.

Cloquet (1818a), in an article which appears to be an abstract of Lænnec (1804a or 1812a), has made a positive statement of Lænnec's tentative inclusion of the rabbit as a host of the gid parasite.

Leblond (1837a) notes that Lænnec (1812a) did not know of any vesicular worms from the brain of the rabbit, and describes a cyst taken from the vertebral canal of a rabbit by Dr. Emmanuel Rousseau and sent to Leblond, who finds it to be *Cœnurus cerebralis*. De Blainville (1828a) had previously described a cœnurus, which he calls an *Echinococcus*, from the peritoneal cavity of a rabbit. This and subsequent records of the sort have been usually, and probably correctly, taken as cases of *Multiceps serialis*, which was described as a separate species by Gervais (1847a). Gervais and van Beneden (1859b) have examined Leblond's specimen and think it is not *C. cerebralis*. Klencke (1844a) claims to have produced a cœnurus in the rabbit brain by inoculating the brain with bits of rotten cœnurus, but such a claim settles that his record has no right to recognition.

Numan (1850b) states that Engelmeyer in 1850 recorded the presence of a cœnurus in the liver of a cat, and as Numan treats of only one species of cœnurus, the inference is that this was an infection

with *Multiceps multiceps*, which, however, would be a highly improbable occurrence. Engelmeyer's article is not available for verification, but Neumann (1893i) has attempted to verify this record and finds that Engelmeyer's case is a quite ordinary record of *Echinococcus* in the liver of a cow. According to Neumann, the error arose from Numan writing "kat" instead of "koe." Neumann criticises Cobbold for translating Numan's "Veelkop" as *Cœnurus* instead of *Polycephalus*. The criticism seems hardly fair to Cobbold, as Numan uses *Cœnurus*, *Polycephalus*, and "Veelkop" interchangeably to mean one and the same thing, i. e., the gid parasite. And at the point in question, Engelmeyer's case is cited to show that the "Veelkop" is not confined to the brain and spinal cord. Had Numan intended to include *Echinococcus* in his discussion of "Veelkop," he would hardly have referred to one case from the liver as an exception to the rule that it occurs regularly in the nervous system, as the reverse would be true for *Echinococcus*. It is probable that Numan has erred in including Engelmeyer's case in the way he did, and certain that he quoted it wrongly.

Diesing (1850a) and many subsequent writers have listed *Multiceps multiceps* from the camel, the authority, where given at all, being usually De Blainville (1824a). By a coincidence, or by one author misleading the other, Numan (1850b) in the same year assisted in strengthening Diesing's error by also listing the parasite from the camel, basing the statement on De Blainville's case in Aran (1841a). As a matter of fact, Aran says that De Blainville found the parasite in a chamois, and De Blainville himself says it was a chamois. The explanation appears to be that either Diesing or Numan or both of them confused "chamois" and "chameau," or perhaps the printer did. Espejo y del Rosal (1905*β*) says that Lafosse saw the gid parasite in the camel. Lafosse (1854b) has noted gid in the sheep and (Jacques and Lafosse, 1854b) in the antelope, but never in the camel so far as available records show. At any rate, there is no authority at hand for listing the camel as a host of *Multiceps multiceps*.

It has already been shown (p. 35) that Diesing (1850a) erred in crediting Retzius with listing *Multiceps multiceps* from *Cervus tarandus*, as Retzius (1790a) records it from the chamois, not the reindeer.

Diesing (1850a) also states that what is probably a specimen of *Cœnurus cerebralis* is known "Ex *Ipalacis capensis*." There is no mammal genus from which the genitive "*Ipalacis*" could be derived, and Diesing (1864a) has later given the name as *Spalax capensis*, in this case merely calling the parasite a cœnurus. Von Linstow (1878a) lists the host as *Georhynchus capensis*, and it seems likely that the cœnurus in question was taken from this host, the generic name of which is properly *Georychus*, according to Palmer (1904a). The true *Spalax* does not occur in the locality given. From such a

host as this rodent it is altogether unlikely that the parasite was *Multiceps multiceps*.

A writer in the Veterinarian (1855α) states that *Cœnurus cerebralis* is found in the brain of the sheep, ox, horse, pig, and man. There is no citation of authorities or cases to back the assertion, and it is evident that the pig is included here through error. Kolster's (1893a) doubtful case has already been discussed.

Fuchs (1859a) lists the gid parasite from the sheep, cow, and horse, specifying the brain and spinal cord in all cases. It seems quite evident that there was nothing but the possibility of its occurrence in the spinal cord of the cow to justify this statement, and as no record of such an occurrence seems to have been made until half a century later, this statement may be rejected.

It has already been pointed out (p. 31) that Von Nathusius's case, as given by Leisering (1862a), who reported it, was one of subcutaneous cœnurus in the sheep. Pagenstecher (1877a), Moniez (1880a), Leuckart (1886d), and Railliet (1893a) have erred in reporting this from the calf or ox. Von Linstow (1878a) has perhaps followed Pagenstecher in listing *C. cerebralis* from under the skin in the cow.

Neumann (1888a) devotes a paragraph to gid in the goose, quoting Hering's (1861α) case, and stating that the tumor found on the brain was considered as a dead and atrophied hydatid. As a matter of fact, Hering says that a mass without membranous structure, as is often the case in shriveled bladderworms, was found in the left hemisphere of the cerebrum, but nowhere a hydatid.

Railliet (1893a) states that the cœnurus found by Heincke in the eye of a horse is usually referred to *Cœnurus cerebralis*. Heincke (1882a), according to a secretary's abstract, found a bladderworm in the eye of a foal. Under the microscope the worm showed a hook circlet. There is nothing to indicate that the cestode was a cœnurus, and as the description would fit *Cysticercus cellulosæ*, known as a parasite of the eye and of the horse, it seems more reasonable to consider it as this than to assume, contrary to the evidence of the one circlet of hooks, that we had here a cœnurus in an organ nowhere authentically recorded as a site of *C. cerebralis*, and in a host which is none too certainly listed as a host of cœnurus. Neumann (1888a) considers Heincke's form a cysticercus.

Hassall (1898a), in a list of hosts and parasites, records *Cœnurus cerebralis* from the sanbur, *Cervus unicolor*. As no authority is given, and as no such record is to be found, the case appears to be an error.

Similarly, Vaullegeard's (1901a) record of the same parasite from the eye of the cow and of the antelope is without authority or record of cases and is rejected as improbable and devoid of evidence.

THE OCCURRENCES OF THE ADULT MULTICEPS MULTICEPS.

So far as the writer is aware, the dog is the only known host of the adult *Multiceps multiceps*. Von Linstow (1878a) lists *Tænia cœnurus* from *Canis lagopus*, but the three authorities referred to by him in this connection, Diesing (1864a and 1864b), Leuckart (1856a), and Krabbe (1865c), do not mention it. Railliet (1893a) states that Möbius found *T. cœnurus* in *Vulpes lagopus*, but no reference is given, and I have been unable to verify this statement. Hence the blue fox must be considered a doubtful host of *Multiceps multiceps*.

Hering (1873a) fed a common red fox, *Canis vulpes*, with larval *Multiceps multiceps* on three occasions and once fed two *Cysticercus tenuicollis*. The fox passed numerous proglottids, but when finally killed post-mortem examination showed only three tapeworms 2 to 3 inches long. According to Hering, these were *T. cœnurus*. They seemed to be when compared with other specimens on naked-eye examination. Further, the fox had been fed for a year and a half on horse meat, and three tapeworms could not have arisen from two cysticerci. However, there were 42 to 48 hooks instead of 28 to 36, and the large hooks measured 0.65 mm. long. Such a hook measurement is four times the average for *Multiceps multiceps*, and if correctly given would make it quite certain that the cestode in question was not *M. multiceps*. The uncertainty is such that *Canis vulpes* must be considered a doubtful host of *M. multiceps* in this case.

Braun (1894a) gives a reference to Fürstenburg (1858a), not available to the writer, and states that Fürstenburg fed *Cœnurus cerebralis* and *Cysticercus tenuicollis* to dogs and foxes and recovered tapeworms 45 to 50 inches long from the dogs and one-fourth to 7 inches long from the foxes. It is uncertain from this statement whether the tapeworms in the foxes included *Tænia cœnurus* or not.

All other statements that the fox is a host of this parasite appear to be mere assumption, without case or authority to support them.

The assertion or assumption that the wolf is a host of *M. multiceps*, made by Küchenmeister (1853e), Von Siebold (1854b), Bourcier (1859a), Gervais and Van Beneden (1859b), Baillet (1866b), and numerous others, is likewise without cases or authority to support it, and the wolf can not even be listed as a doubtful host so far as the records go. In view of the close relationship of wolves to the dog, however, it is very probable that they may serve as hosts of the adult gid parasite.

Equally devoid of basis, so far as actual records are concerned, are the claims made or suggested for the martin by Von Siebold (1854b), Pütz (1882α), and Dewitz (1892b), for the coyote by Curtice (1890c), Burch (1893α), and Shaw (1901a), and for the polecat by Dewitz (1892b).

Railliet (1893a) states that he has been unable to infect the cat.

The writer has personally examined tapeworms from coyotes and other wolves trapped in Montana, but has not found *M. multiceps*. Doctor McClure, in a letter of December 5, 1906, to Doctor Melvin, says he has examined two coyotes in Montana and found no intestinal parasites.

The following list includes all records found of the occurrence of the adult *Multiceps multiceps* not produced by feeding experiments and many of the cases where it has been produced by experiment. In the case of the latter some effort has been made to avoid duplication, due to translations, later editions, etc. The list does not include those cases where the occurrence of the parasite is merely claimed.

List of recorded occurrences of the adult Multiceps multiceps in the dog.

Locality.	Authority.	Notes and comments.
Germany	Von Siebold 1852a	By experiment.
Do	Küchenmeister 1853e	Do.
Do	Haubner 1854b	Do.
Do	Von Siebold 1854b	Do.
Do	Küchenmeister 1855f	By experiment; first trihedral specimen.
(?)	Fürstenburg 1858a	By experiment; according to Braun (1894a).
Germany	Hering 1859a	By experiment.
France	Baillet 1859b	Do.
England	Gamgee 1859a	Do.
France	Pouchet and Verrier 1862b	Do.
Denmark	Krabbe 1862a	Found in 4 out of 185 dogs.
France	Milne-Edwards and Vaillant 1863a.	By experiment.
Denmark	Krabbe 1865d	Found in 5 out of 500 dogs.
Iceland	do	Found in 18 out of 100 dogs.
Faroe Islands	do	Rare.
England	Cobbold 1867o	By experiment; never otherwise.
Germany	Hering 1873a	By experiment.
Italy	Perroncito 1877cc	Do.
France	Bertolus and Chauveau 1879a	Found in 1 out of 84 dogs.
Germany	Leuckart 1880b	By experiment; a trihedral specimen and 1 with genitalia reversed.
Do	Schöne 1886a	Found in 1 out of 100 dogs.
Switzerland	Zschokke 1887a	Found in 3 out of 177 dogs.
France	Neumann 1888a	Not stated.
Germany	Deffke 1891a	Found in 1 out of 200 dogs; also by experiment.
United States	Curtice 1892g	This is an error; see p. 21.
Do	Ward 1896b	Ward (1897b) and Stiles (1898a) think this is *M. serialis*.
Germany	Lehner 1897a	Found in 4 dogs.
Italy	Calamida 1901c	Not stated.
Scotland	Law 1903a	By experiment in 1864 or 1865; date and place furnished me in personal communication of July 2, 1909.
Germany	Johne 1904f	By experiment; a trihedral specimen.
Australia	Brown 1902a	Not available; cited from Sweet 1909a.
United States	Hall 1909a	By experiment.
France	Henry 1909a	Dog died of intestinal obstruction due to mass of *Multiceps multiceps*.
United States	Taylor and Boynton 1910a	One specimen said to have been produced by feeding cœnurus.
Do	Hall 1910β	This article.

ECONOMIC IMPORTANCE OF GID.

In the seventeenth century Scultetus (1672a) notes that gid was common enough then in Germany to be known among the peasantry under the name of "Wirbling." In the eighteenth century Wepfer (1724α) says it was a common disease of cattle in Switzerland. Maillet (1836a) says it is more common in southern than in northern

France. Von Siebold (1854b) states that gid is not rare in cattle in south Germany, especially Bavaria, but that it is scarcely known in north Germany, and Zürn (1882α) says it causes great loss among sheep in south Germany. Krabbe (1865d) found the adult parasite very common in dogs in Iceland, and the gid disease must have been very common, as he says, for the cystic stage is much more commonly found than the adult. Cobbold (1867o) says the disease is not important in England, but is in Hungary, though later Heatley (1884α) says that gid is very common in England. Wernicke (1886a) states that the parasite is viewed with alarm in the Argentine Republic. Möller (1891a) says cœnurus is common in cattle at the Salzburg slaughterhouses, and is not rare in Steiermark, Kärnten, Tyrol, Bukownia, and Dalmatia. Scheben (1910α) says that gid is an old trouble in German Southwest Africa, often becoming conspicuous by its damage to sheep breeding, and now and then occurring as an epizootic.

It will be seen from the above that while gid enjoys a wide distribution, there are some districts which appear to favor the disease, and in these places there is a constant and considerable economic loss from the disease. How great that loss is may be judged from a few figures.

Youatt (1834a) says that at least 900,000 sheep die annually of gid in France. (Most authors quote Youatt as saying a million sheep, but I have not found this statement.) Belhomme (1838a) says that in some years gid attacks one-fifth to one-fourth of a flock. Barthelemy (1839α) says not less than one-fifth of the lambs suffer from gid in France. Reynal (1852α) notes the loss of 50 out of a flock of 110 lambs from this disease, and Clok (1868α) notes Kuers's case, where 200 out of 400 died of gid. Reynal (1857a) states that gid attacks from one-tenth to more than one-fourth of the sheep in some places. Von Siebold (1854b) says gid kills more than 10 per cent in some flocks. Clok (1868α) says the average yearly loss from gid is 5 to 6 per cent, and that in Germany it may kill 70 per cent of the lambs. Heitzmann (1868a) says that at Rohrdorf 50 to 60 head of cattle die in some years. Dixon (1883α) says that before the fencing in of sheep runs began in South Australia it was not unusual for 2 per cent of the hoggets to die of "crankiness," or gid. Neumann (1892a) states that Gasparin put the loss in Germany at 15 per 1,000 the first year, 5 the second, 2 the third, and 1 the fourth. Armatage (1895) says of gid: "The annual losses are about 10 per cent. It always prevails in some districts, particularly in Scotland." Not long ago Penberthy (1906α) noted a case in England where 300 out of 400 lambs died of gid inside of four months. Numan (1850b) says that gid is not as common in Holland as in some countries, and claims that Tessier put the loss in France at 5 per cent, and that Kuers in 1840 stated the loss in Germany as no less than this. Diem (1906α) points out that with existing values gid in cattle causes an appreciable

loss, and notes instances where the values of cattle successfully operated on increased over their slaughter value as giddy animals from 35 and 55 to 485 marks. Vollrath (1905a) states that during the winter and spring of 1904–5 there were one or two cases weekly among cattle at Uttenweiler. Pfab (1910α) notes two cases where cattle breeders lost an entire year's increase; in one case 8 animals out of 8, and in another 12 out of 12. He records a total of 58 operations on cattle in the years 1903 to 1909, inclusive, with 34 cures. The figures already given for the United States, and the writer's personal investigation in Montana, show losses of 2 or 3 to 10 per cent among some Montana flocks, and such a loss in a State where sheep are rated by the Bureau of Statistics [a] of the United States Department of Agriculture at $4.20 a head is worth considering. It appears that the loss in Montana amounts to $10,000 in some years, and is at all times a steady drain on the flocks.

It is evident from these figures that gid is really a dangerous and important disease. It has held its own for centuries in civilized Europe. Nearly a century ago, Bose (1816a) said it was notable for the loss of sheep which it occasioned. Later Eschricht (1840b) speaks of it as a plague. Kuers in 1840, according to Numan (1850b), classed it as one of the three most important diseases of lambs. Eschricht (1841g) says it "often rages * * * as a virulent contagion." Clok (1868α) says it may be regarded as producing the greatest comparative loss of all sheep diseases. Van Beneden (1889a) says "The cœnurus of the sheep is a true calamity when it spreads in a country." Dewitz (1892b) says gid is the most important parasitic disease of sheep around Berlin. In Germany the Government was trying to stamp out the disease before the middle of the last century, and Küchenmeister was working under a government grant when he demonstrated the complete life cycle of the parasite in 1853.

The sheep is conspicuous for its comparative freedom from bacterial diseases, a fact especially noticeable at this time, when the cow and other animals are being called to account in the tuberculosis campaign. But the sheep is equally conspicuous for its susceptibility to animal parasites, and of these the gid parasite is one of the most deadly. In this country gid is not as widespread as infection with the stomach worm, *Hæmonchus contortus*, nor is it so general throughout the flocks it attacks as scab. At the same time, the stomach worm at its worst can not claim anything like the approximate 100 per cent lethality of the gid parasite, and the scab parasite is readily eliminated by a rather simple routine treatment, not comparable to the delicate and uncertain surgical treatment necessary to relieve a sheep of the brain parasite. Unlike

[a] Crop Reporter, U. S. Department of Agriculture, vol. 12, no. 2, February, 1910.

bacteria, animal parasites show little preference in attacking weak or poor animals, and gid probably selects its victims oftener from strong, vigorous sheep and with less regard to the care given them than even the stomach worm or the scab parasite.

Neumann (1888a) and many others, previously and since, state that in general giddy animals should be butchered in the first stage of gid, as the meat is still good. In the case of valuable animals, an operation should be undertaken if indicated by favorable symptoms. He also urges that sheep affected with spinal gid should always be killed. His advice is perhaps as good as could be given. In general, the greater value of cattle, as Pütz (1882α) has noted, would justify an operation oftener than sheep values would. This is especially true since the wool value of the living sheep is considerably less than the dairy value of the living cow. The figures already quoted from Diem (1906α) show the value of successful operations. Operation is, of course, especially indicated in the case of breeding animals. We know of no adequate medicinal treatment for gid, and experiments along this line have so far been unsuccessful. (See Hall, 1909α and Moussu, 1910α.)

It seems that animals affected with gid seldom get to the larger slaughterhouses, although F. Braun (1906α) says he has often found it in meat inspection of cattle. Edelmann (1896a) says *Cœnurus cerebralis* is ordinarily unimportant in meat inspection, but that in Hesse and Sachsen-Meiningen the meat of giddy animals is to be held as depreciated in value or worthless, according to the degree of the disease and the condition of the carcass. Carreau and Rousseau (1909α) give directions for detecting giddy sheep in abattoir inspection in France. Lloyd (1909α), in an article on meat inspection in England, lists *Cœnurus cerebralis* as one of the most common larval cestode parasites involved in meat inspection, and Clarke (1907α), as already noted, says he has met many cases of gid in sheep at the slaughterhouses in England. Moreau (1909α), in an article on meat inspection, gives the methods for detection of the gid parasite and lists animals so infected for partial condemnation.

Bourrier, Charpentier, and Lafourcade (1884a) only found the gid parasite once after five and a half years at the Villette abattoir, in spite of a careful examination of the brains of the 18,000 to 20,000 cattle that were slaughtered there monthly. Schöne (1886a) only found it once among 8,962 sheep at Chemnitz.

From a legal standpoint, gid constitutes an impairment of contract in cattle sales in some places in Europe, according to Semmer (1885c), who gives this period as 14 days in Nassau and Thurgau, 15 days in Canton St. Gallen, and 31 days in Canton Schaffhausen. These periods are too short, as Semmer notes. Gerlach (1872a), who gives the same figures, says the period should be three months, but states

that such a fixed period can be dispensed with on the ground that only an occasional breeding ram comes up for consideration, and especially because we are in a position from a scientific standpoint to render a correct judgment on any concrete case. Heusinger (1853α) states that in the "Ancient Laws and Institutes of Wales" the law governing impairment of contract allows three days for the development of "dera," or vertigo, in sheep, cattle, and horses. I am unable to state whether this covers cases of gid or not.

ALLEGED CAUSES OF GID.

Before the gid parasite was known as the cause of gid various theories were advanced to account for the disease, and after the parasite was known to be the cause many theories were advanced to account for its presence. Nor did the proposal of new theories cease after Küchenmeister (1853e) had demonstrated the parasite's life history. Below are cited the various theories found by the writer, only one authority being assigned for any given theory.

Stier (1776a) discredits the theories that gid is due to insect larvæ in nose, to inflammation, to stagnation of blood, or to hot days followed by cold nights.

Gericke (1805α) considers gid as due to an accumulation of fluid in the head from hypersecretion of glands injured by blows on the animal's head.

Youatt (1834α) opposes the theories ascribing the disease to poisonous plants, delay in docking, to hoarfrost, apoplexy, or to weakness of meninges; also Hogg's theory of gid as due to the injection of fluid from the central canal of the spinal cord into brain.

Maillet (1836a) notes the idea that gid in cattle was due to heavy yokes.

Tschudi (1837a) has a footnote, signed Leuckart, which notes that gid occurs in unhorned sheep and that certain formative material should go into the horns the first year, or, failing that, the high blood pressure favors cyst production.

Schellhase (1839α) objects to the theory of cachexia and malnutrition as causes of gid and proposes the opposing theory that the heightening of the vegetative life of sheep by suppression of activity in the period of youth causes a superfluity of material which gives rise to worms.

Eschricht (1840b) favors the idea that bad feeding and wet meadows give rise to gid.

Blacklock (1841α) adopts a theory, credited by him to Hogg in 1812, that gid is due to the back of the sheep being chilled.

Pluskal (1844α) quotes the following theories of spinal gid: That it is due to chilling, metastasis, rheumatic-toxic trouble, too much jumping, excessive stretching of hip ligaments, and feebleness of the ram.

Numan (1850b) notes that gid has been referred to bad food and water, *Colchicum autumnale*, *Allium vineale*, *Ranunculus flammula*, an adder, damp stalls, cutting teeth, and temperature variation.

Reynal (1858a) thinks that gid is due to heredity or the breeding of too young animals.

Gamgee (1859a) cites Naviéres's theory that a fly perforated the sheep's skull and deposited eggs.

Davaine (1860a) mentions the theory of gid as due to precocious obesity.

Dun (1864α) puts forth a common mixture of truth and error, rather than a theory, when he says that sheep pick up the eggs or larvæ of tapeworms dropped by dogs, rabbits, or sheep, and that the ova of flukes also cause gid.

Fürstenburg (1865b) condemns Mahnke's theory that gid parasite eggs get into the blood and are destroyed, the dissolved product subsequently uniting with the egg or semen of the host, thus forming a fetus which later becomes the parasite.

Vollrath (1905a) states that in advising farmers to have their cattle operated on for gid he met with marvelous causes for the disease, and this, too, in Germany where the knowledge of the etiology and prophylaxis of the disease has coexisted with the disease for half a century. It is not, therefore, surprising that, according to Doctor Treacy, of this Bureau, in a letter of June 5, 1907, the sheepmen of Montana have been classing the gid trouble as loco, poison weed, water on the brain, grub in the head, etc., "and have not paid any attention to the destruction of the animals that have died."

NAMES APPLIED TO GID AND GIDDY ANIMALS.

The wide distribution of gid and the peculiarity of its symptoms have led to its receiving a great number of popular names in various languages. In the following lists these names, together with the medical names, have been arranged in chronological order under each country. Where the name is applied to a giddy sheep instead of to the disease it is indicated by an asterisk (*), and where the term applied is an adjective it is indicated by a dagger (†). Spinal gid is indicated thus (§). This list is necessarily incomplete, especially as regards terms used in Asia, from which continent no records of gid are available, although the disease probably occurs there.

The authority cited for a name will often, but not always, be the one found using it first. In every case the question of the propriety of using the word to denote gid, or infection with *Multiceps multiceps*, must be referred to the authority cited.

GERMANY.—Rolfinck 1656a, *Vertigo;* Scultetus 1672a, *Wirbling;* Guetebruck 1766α; *Drehnigkeit, Dummlichkeit, Taubsucht, Verrückung der Sinnen;* Batsch 1786a,* *Dreher,*

**Seegler;* Gmelin 1790a, *Drehen, Springen;* Stier 1776a, †*drehende;* Bloch 1782a, *Drehkrankheit, *Springer, *Segler;* Frenzel 1794a, †*albern, Dämischseyn, Drehlinge, Drehsucht, Dummheit,* †*elbisch, Irregehen, Kreislauf, Läppischseyn, Ringlichtwerden, Schwindel, Seglen, Taumeln, Traben, Verrückung, Würflichtseyn;* Rohlwes 1813a, **Dähmeler, *Ringläufer, *Traber;* Numan 1850b, *Dummsein, Eibischwerden, Kopfkrankheit, Ringläufen, Ringlicht;* Hering 1853α, *Dippelkrankheit, Dipplichkeit;* Reynal 1854b, **Wurfler;* Spinola 1858b, **Irrlinger, *Propheten, *Schwindler, *Seitlinge;* Blumenbach 1802a, *Quecsenkopfe;* Pluskal 1844α, *Drehe,* §*gebrochenes Kreuz,* §*Gnubberkrankheit, Hydrocephalus hydatideus,* §*Hydrops hydatibus medullæ spinalis, Hydrops hydatideus ovium,* §*Kreuzdrehe,* §*Kreuzlähme,* §*Tabes dorsalis, Traberkrankheit;* Küchenmeister 1855f, *Dreh-Krankheit;* Gurlt 1831a, §*Atrophia medullæ spinalis;* Erdt 1870a, **Reitbahndreher, *Zeigerdreher;* Gerlach 1872a, *Kollern;* Pütz 1882α, **§Kreuzdreher, *§Kreuzschläger, *Taumler;* Möller 1891a, *Drehwurmkrankheit;* Friedberger u. Fröhner, 1904α, *Blasenschwindel, Drehbewegung, Kopfdrehe, Kreisbewegung, Manegebewegung, Narrischsein, Quesenkopf, Reitbahnbewegung, Rollbewegung, *Schwinder, Taumelsucht, Tölpischsein, Wälzbewegung, Zeigerbewegung;* Braun, F. 1906α, †*dämisch;* Diem 1906α, †*würfig;* Worbs 1909α, †*würflig;* Pfab 1910α, *Coenurus-Krankheit.*

France.—Bloch 1788a, *sauteuse, tourneuse;* Moorcroft 1792a, *tournoiement, vertige;* Bosc 1816α, *tournis;* Carrere 1826α, *lourd;* Numan 1850b, **tourneurs;* Reynal 1857a, *avortin, *cingleur, lourderie, *trotteur, *voilier;* Cruzel 1869a, *avertin;* Benion 1874a, **portant au vent,* §*paraplégie hydatique;* Neumann 1892a, *étourdissement, hydrocéphale,* §*tournis lombaire, vertigo;* Armatage 1895, *étourdi, éturdi.*

England.—Moorcroft 1792a, *gid, turn;* Home 1795a, *staggers;* Turton 1806α, *dunt, rickets;* Schulling 1821α, *sturdy;* Youatt 1834α, *gig, goggles, turnsick;* Veterinarian 1855α, *vertigo;* Spooner 1888a, *blob-whirl, giddiness, sturdy-gig;* Neumann 1892a, §*hydatic paraplegia, hydatido-cephalus, hydatid on the brain,* §*lumbar gid,* §*medullary gid, punt, turnside;* Armatage 1893α, *hydrocephalus hydatidæus;* Armatage 1895, *cœnurus cerebralis, hydatids;* Penberthy 1897c, *cœnurosis;* Cave 1903α, *pothery.*

Lapland.—Hoffberg 1759a, *Ringsjuka.*

Ireland.—Bellingham 1844a, *staggers.*

Scotland.—M'Call 1857a, *sturdy.*

Holland.—Numan 1850b, **Draaijers, Draaiziekte, *Dravers,* §*Kruislamheid,* §*Schuurziekte, *Zeilers;* Blumenbach 1802a, *Draaikoppen.*

Italy.—Fontana 1784a, *folie, *fols, male vertiginoso, storno;* Neumann 1892a, *vertigine idatiginosa, vertigine per cenuro.*

Denmark.—Krabbe 1864h, *Dreiesyge.*

Cape Colony.—Hellier 1894a, *Mal-Kop;* Buckley 1904α, *Malkopziete, Malkop Ziekte;* Hutcheon 1904α, *gid, sturdy, turnsick;* Gilchrist 1909α, §*lumbar-gid.*

Argentine Republic.—Armatage 1895, †*moonstruck;* Monfallet 1899α, *locura de las ovejas.*

South Australia.—Dixon 1883α, *crankiness, tumsick.*

Chile.—Monfallet 1899α, *cenurosis,* §*paraplejia hidatica, torneo, torneo encefalico,* §*torneo lumbar.*

Spain.—Monfallet 1899α, *modorra;* Espejo y del Rosal 1905α, *torneo.*

Switzerland.—Retzius 1790a, †*sturmig.*

United States.—Livingston 1809α, *dizziness, staggers;* Clok 1847α, *water in the head;* Verrill 1870d, *gid, sturdy, vertigo, water-brain;* Tellor 1879a, *hydatid in the brain, hydatid of the brain, turnsick;* Crutchfield 1880α, *hydatid on the brain;* Killebrew 1880α, *hydatids;* Stewart 1880a, *giddiness, turnside;* Powers 1887a, *blind staggers;* Burch 1895α, *turnsids;* Sommer 1896c, *turnstick;* Campbell & Lacroix 1907α, *turn sickness;* letter of Dr. Cary to Dr. Treacy, May 21, 1907, †*locoed.*

The writer finds that in Montana gid is known as loco, lamb loco, bug in the head, and blind staggers, and that giddy sheep are commonly said to be crazy.

To the above list might be added ἱερα νοσος, the Greek for "the sacred disease," epilepsy, by which Hippocrates (1825α) designates various forms of vertigo in man and animals, and under which term it is likely that gid in sheep was known. There should also be added the Latin term, "tornatio," used by Acharius (1782) but not assigned to any country.

Unless an author specifies otherwise, it is assumed that a term used by him for gid was in use in the country from which or of which he wrote. This accounts for the terms listed from the United States at a time when it is doubtful whether there was any gid in this country.

As the present writer has not been in a position to check all errors of spelling as such and can not guarantee that they were not local variations, all names are included as found, even where it seems fairly clear that there is an error, as in the case of "turnstick" of Sommer (1896c).

The term "locoed" is included on the strength of Doctor Cary's statement that in his opinion it includes in Montana sheep that are actually suffering from gid, and on the evidence of Dr. E. T. Davison, who reports under date of December 21, 1907, that he has examined several sheep reported as "locoed" and found them all infested with the gid parasite. The writer has found that giddy sheep are very commonly referred to in Montana as locoed, and in one place, where no loco weed or loco disease existed, gid was known as lamb loco.

Such a term as "ringsjuka" is included on the possibility, discussed elsewhere, of the disease in question being gid.

The term "moonstruck," referred to the Argentine Republic by Armatage (1895), is presumably a translation.

COMMON NAMES OF THE GID PARASITE.

The following list is not complete, but covers the commoner names used in the more important countries, one authority for the name being cited:

GERMANY.—Blumenbach 1802a, *Die Queese;* Gurlt 1831a, *Gemeinschwanz, Vielkopf;* Küchenmeister 1855f, *Schaafquese;* May 1855a, *Gehirn-Vielkopf;* Leuckart 1863a, *Drehwurm;* Erdt 1870a, *Cœnurusblase;* Zürn 1882α, *Gehirnblasenbandwurm, Gehirnblasenwurm, Gehirnquese, Quesenbandwurm.*

FRANCE.—D'Arboval 1827a, *cœnure cérébrale;* Von Siebold 1852a, *Ver du tournis;* Neumann 1888a, *cénure cérébrale.*

ENGLAND.—Moorcroft 1792a, *social hydatid;* Cobbold 1874c, *gid hydatid, many headed hydatid;* Cobbold 1874v, *gid-hydatid tapeworm.*

HOLLAND.—Blumenbach 1802a, *Herszen-Blaas-Worm;* Numan 1850b, *Vielkop-Blaasworm der Herscnen.*

CAPE COLONY.—Gilchrist 1909α, *water-bags.*

UNITED STATES.—Verrill 1870d, *water brain;* Stiles 1898a, *gid bladder worm.*

A Scotch sheepman in Montana refers to the gid parasite as the "sturdy bag" and states that it is commonly known by this name in Scotland.

SYNONYMY.

The following table of synonymy is based on over 600 references and is probably very nearly complete. The essential discussion of the correct names of the parasite has already been given under the historical sketch:

Genus MULTICEPS Goeze 1782a.

1782. *Multiceps* Goeze 1782a.
1782. *Cerebrina* Acharius 1782; erroneously substituted for *Multiceps*.
1782. *Tænia vesicularis* Goeze 1782a, *pro parte*.
1786. *Hydatigena* Goeze 1782 of Batsch 1786a, *pro parte*.
1788. *Vesicaria* Schrank 1788a.
1790. *Hydatula* Abildgaard 1790, *pro parte*.
1798. *Hydatis* Virey 1798a, *pro parte*.
1800. *Polycephalus* Zeder 1800a; *Multiceps* renamed.
1808. *Cœnurus* Rudolphi 1808a; *Multiceps* and *Polycephalus* renamed.
1815. *Polycephops* Rafinesque 1815a; *Polycephalus* renamed.
1818. *Hydatidula* Cloquet 1818a; misspelling for *Hydatula*.
1824. *Cœnurus* Bremser 1824a, for *Cœnurus*.
1830. *Cœnureus* Bory de St. Vincent 1830a; misprint for *Cœnurus*.
1830. *Vesicularia* Schrank of Bory de St. Vincent 1830a; Bory de St. Vincent 1830a is author of *Vesicularia;* misspelling for *Vesicaria*.
1831. *Cœnurs* Gurlt 1831a; misprint for *Cœnurus*.
1844. *Canurus* Goodsir 1844g; misprint for *Cœnurus*.
1850. *Tænia* Goeze of Diesing 1850a; in synonymy of *Cœnurus;* Linnaeus 1758a is author of *Tænia*.
1850. *Hydatula* Batsch of Diesing 1850a; in synonymy; Abildgaard 1790 is author of *Hydatula*.
[1870.] *Cœnurias* McClure [1870α]; misprint for *Cœnurus*.
1895. *Cenurus* Armatage 1895; misprint for *Cœnurus*.
1900. *Cystotaenia* R. Leuck. of Braun 1900a; error.
1902. *Vermis* Bloch 1782a of Sherborn 1902a. See discussion of synonymy.
1905. *Cœncerus* Vet. Ed. Amer. Sheep Breeder 1905δ; misprint for *Cœnurus*.
1905. *Cœnurus* Cuvier 1825a of Stiles and Stevenson 1905a; Bremser 1824a is author of *Cœnurus*. [Schinz, and not Cuvier (1825a), should be held responsible for the use of this form. See discussion of synonymy.]

Species MULTICEPS MULTICEPS (Leske 1780a) Hall 1910β.

1780. *Tænia multiceps* Leske 1780a.
1780. *Vermis vesicularis socialis* Bloch 1780a.
1782. *Tænia vesicularis cerebrina* Goeze 1782a.
1782. *T. vesicularis, multiceps* Acharius 1782.
1786. *Hydatigena cerebralis* Batsch 1786a.
1787. *Tœnia globuleux* of Chabert 1787a, *pro parte;* misdetermination.
1787. *Ténia globuleux* of Chabert 1787a, *pro parte;* misdetermination.
1788. *Vesicaria socialis* (Bloch 1780a) Schrank 1788a.
1790. *Tænia cerebralis* (Batsch 1786a) Gmelin 1790a.
1790. *Tænia socialis* (Bloch 1780a) Retzius 1790a; probably 1786a.
1790. *Tænia cerebrina* (Goeze 1782a) Retzius 1790a; probably 1786a.
1790. *Tæniae cerebrinae* Retzius 1790a; probably 1786a.
1795. *Tænia hydatigenia* Home 1795a.
1795. *Tænia hydatigena* of Home 1795a; error.
1798. *Hydatis cerebralis* (Batsch 1768a) Virey 1798a.

1800. *Tænia visceralis multiceps* Goeze (1782a) of Zeder 1800a; this combination should be attributed to Zeder 1800a.
1800. *Tænia multiceps* Goeze (1782a) of Zeder 1800a; this combination should be attributed to Leske 1780a.
1800. *Tænia hydatigena* Pallas (1766b) of Zeder 1800a; error.
1800. *Tænia cerebralis* Syst. Nat. Linn. (1790) of Zeder 1800a;=Gmelin 1790a.
1803. *Hydatula socialis* (Bloch 1780a) Schrank 1803a.
1803. *Polycephalus ovinus* Zeder 1803a.
1803. *Polycephalus bovinus* Zeder 1803a.
1804. *Tænia vesicularis cerebrina multiceps* Goeze (1782a) of Lænnec 1804a; this combination should be attributed to Lænnec 1804a.
1804. *Tænia cerebralis* Bruguière of Lænnec 1804a; this combination should be attributed to Lænnec 1804a apparently; Bruguière (1792a) uses *Tænia* but does not involve this species; Bruguière (1791a) in the accessible copy has this part in script and hence unreliable; form given is *Ténia cérébral*, unscientific.
1804. *Hydatis cerebralis* Bosc [1802a] of Lænnec 1804a; this combination should be attributed to Virey 1798a.
1804. *Polycephalus cerebralis* (Batsch 1786a) Lænnec 1804a.
1808. *Cœnurus cerebralis* (Batsch 1786a) Rudolphi 1808a.
1810. *Hydatula cerebralis* Batsch (1786a) of Rudolphi 1810a; this combination should be attributed to Rudolphi 1810a.
1810. *Tænia vesicularis* Goeze (1782a) of Rudolphi 1810a; in synonymy; is a generic, not a specific synonym.
1818. *Hydatidula cerebralis* Batsch (1786a) of Cloquet 1818a; this combination should be attributed to Cloquet 1818a.
1818. *Tænia vesicularis cerebrina multiceps* Goëze [1782a] of Cloquet 1818a; this combination should be attributed to Cloquet 1818a.
1825. *C*[*œnurus*] *cerebralis* (Batsch 1786a) Bremser 1824a.
[1828.] *Cysticercus tenuicollis* of Buzaringues [1828α] in Reynal 1857a; misdetermination.
1831. *Cœnurs cerebralis* (Batsch 1786a) Gurlt 1831a.
1833. *Cœnurus cerebralis* Lamarck and Rudolphi of Rose 1833a; this combination should be attributed to Rudolphi 1808a.
1834. *Cysticercus tenuicollis* of Youatt 1834α.
1834. *Hydra hydratula* Linnæus of Youatt 1834α.
1837. *Polycephalus cœnurus* Tschudi 1837a.
1837. *Polycephalus cerebralis* Cloquet (1818a) of Tschudi 1837a; this combination should be attributed to Lænnec 1804a.
1844. *Polycephalus cerebralis* V. of Pluskal 1844α; this combination should be attributed to Lænnec 1804a. [V.=Virey?].
1844. *Tænia vesicularis cerebralis* G. of Pluskal 1844α; this combination should be attributed to Pluskal 1844α. [G.=Goeze?].
1844. *Hydatis cerebralis* Bl. of Pluskal 1844α; this combination should be attributed to Virey 1798a. [Bl.=Blumenbach?]
1844. *Hydatis polystomos medullaris* Pluskal 1844α.
1844. "*Tænia cerebralis* (Pennant, Turton)" of Bellingham 1844a; this combination should be attributed to Gmelin 1790a.
1848. *Tænia vesicularis* Goeze 1782 of E. Blanchard 1848c; this combination should be attributed to Lænnec 1804a, apparently.
1848. *Hydratula cerebralis* (Batsch 1786a) E. Blanchard 1848c.
1850. *Hidatula cerebralis* Batsch (1786a) of Diesing 1850a; this combination should be attributed to Diesing 1850a.
1850. *Cœnurus serialis* Gervais (1847a) of Diesing 1850a et al; misdetermination.
1850. *Hydatis cerebralis* Blumenbach (1802a) of Numan 1850b; this combination should be attributed to Virey 1798a.

1850. *Tænia hydatigena* Fisscher (1788α) of Numan 1850b; this combination should be attributed to Pallas 1766b.
1850. *Tænia vesicularis socialis* Goeze (1782a) of Numan 1850b; this combination should be attributed to Numan 1850b.
1850. *Polycephalus cerebralis, ovinus* Zeder (1803a) of Numan 1850b; this combination should be attributed to Numan 1850b.
1850. *Hydatis polystomos medullaris* Muskal (1844) of Numan 1850b: this combination should be attributed to Pluskal 1844α.
1850. *Polycephalus ovium* Numan 1850b.
1850. *Hydatis facialis* of Dupuy [Date?] in Numan 1850b; Dupuy not available.
1850. *Cœnurus cérébreux* of Dupuy [Date?] in Numan 1850b; Dupuy not available.
1850. *Tænia globuleux* Chabert of Dupuy [Date?] in Numan 1850b; Dupuy not available.
1850. *Hydatis cerebralis* Lemark of Dupuy [Date?] in Numan 1850b; this combination should be attributed to Virey 1798a.
1850. *Polycephalus* (*Cœnurus*) *cerebralis* (Batsch 1786a) Numan 1850b.
1850. *Tænia cerebralis, vesicularis* von Siebold 1850a.
1852. *Tænia cerebralis* Linné of Reynal 1852α; this combination should be attributed to Gmelin 1790a.
1852. *Polycephalus ovium* Zeder (1803a) of Reynal 1852α; this combination should be attributed to Numan 1850b.
1852. *Tænia multiplex* Leuckart 1852b; a corruption of *Tænia multiceps*.
1853. *Tænia cerebralis* Linnæus of Baird 1853a; this combination should be attributed to Gmelin 1790a.
1853. *Hydatis cerebralis* Bosc of Baird 1853a; this combination should be attributed to Virey 1798a.
1853. *Cœnurus cerebralis* Rud. of Baird 1853a; this combination should be attributed to Bremser 1824a.
1853. *Tænia cœnurus* (Tschudi 1837a) Küchenmeister 1853e; first naming of strobila form.
1853. *Tæniæ cœnuri* Küchenmeister 1853e; plural of *Tænia cœnurus*.
1854. *Tæniis cœnurus* (Tschudi 1837a) Küchenmeister 1854α; plural of *Tænia cœnurus*.
1854. *Tæniæ cœnurus* (Tschudi 1837a) Küchenmeister 1854α; plural of *Tænia cœnurus*.
1854. *Tenia cœnurus* (Tschudi 1837a) Küchenmeister 1854h; misprint for *Tænia cœnurus*.
1854. *Tænia solium* of von Siebold 1854b; misdetermination.
1854. *Tænia serrata* of von Siebold 1854b; misdetermination.
1854. *T*(*ænia*) *cœnures* van Beneden 1854α.
1855. *Cœnurus serdalis* Gervais (1847a) of Goldberg 1855a; this combination should be attributed to Goldberg 1855a; misdetermination and misprint.
1855. *Hidatula cerebralis* Batsch (1786a) of Goldberg 1855a; this combination should be attributed to Diesing 1850a.
1855. *Cysticercus cerebralis* (Batsch 1786a) Goldberg 1855a; used only in genitive in Latin article.
1856. *Tænia cœnurus* v. Sieb. of Leuckart 1856a; this combination should be attributed to Küchenmeister 1853e.
1856. *T*(*ænia*) *vesicularis cerebralis s. multiceps* Goeze (1782a) of Leuckart 1856a; this combination should be attributed to Leuckart 1856a; see Pluskal 1844.
1857. *Tænia cerebralis* Linn. of Reynal 1857a; this combination should be attributed to Lænnec 1804a.
1857. *Polycephalus ovinus* Zider of Reynal 1857a; this combination should be attributed to Zeder 1803a.
1858. *Tnia cœnurus* (Tschudi 1837a) Baillet 1858c; misspelling.
1859. *Tænia marginata* Götze of Fuchs 1859a; error.
1859. *Tæna serrata* R. of Hering 1859a; this combination should be attributed to Hering 1859a; misdetermination, misprint.

1859. *Tænia e cœnuro* Aut. of Hering 1859a.
1859. *Tænia cœnurus* (Tschudi 1837a) Keller 1859a; misspelling.
1860. "*Echinococci*" of Crisp 1860a; error.
1861. *T(ænia) cœnura* Kœberlé 1861a; misprint.
1861. *T(ænia) cœnara* Kœberlé 1861a; misprint.
1861. *C(ysticercus) cœnurus* (Tschudi 1837a) Kœberlé 1861a.
1861. *Tenia canurus* van Beneden 1861a.
1863. *Polycephalus cerebralis* Numan of Diesing 1863b; this combination should be attributed to Lænnec 1804a.
1863. *Cœnurus cerebralis ? leporis cuniculi* Baillet of Diesing 1863b; in synonymy of *Tænia cœnurus*; not at present available, cited from Diesing 1864a, identical; this combination should be attributed to Diesing 1863b.
1863. *Tænia* (*Cystotænia*) *cœnurus* Leuckart 1863 of Diesing 1863b; this combination should be attributed to Diesing 1863b.
1863. *Tænia serrata* Siebold of Diesing 1863b; this combination should be attributed to Goeze 1782a; error.
1863. *Tænia cœnuri cuniculi* Baillet of Diesing 1863b; this combination should be attributed to Diesing 1863b; error.
1863. *Ténia-serrata* of Letort 1863a.
1863. *Tænia multiplex* Götze of Leuckart 1863a; this combination should be attributed to Leuckart 1852b.
1863. *Hydatis polycephalus cerebralis* (Batsch 1786a) Randall 1863a.
1866. *Cœnurus cerebralis* Küch. of Baillet 1866a; this combination should be attributed to Rudolphi 1808a.
1868. *Cysticercus cœnurus* Desmonceaux 1868a.
[1870.] *Cœnurias cerebralis* (Batsch 1786a) McClure [1870α]; misspelling.
[1870.] *Tænia solium* of McClure [1870α]; error.
[1870.] "*Echinococcus, polymorphus* or *vetrinorium*" of McClure [1870α]; error.
1874. *Tænia ovilla* of Bénion 1874a.
1877. *Tænia cœnurus* v. Sieb. of Pagenstecher 1877a; this combination should be attributed to Küchenmeister 1853e.
1878. *Cœnurus cerebalis* von Linstow 1878a; misprint.
1879. *Tænia cenurus* Tellor 1879a; misprint.
1879. *Tænia cœnurus* (Desmonceaux 1868a) Bertolus et Chauveau 1879a.
1879. *Tœnia cœnurus* (Desmonceaux 1868a) Bertolus et Chauveau 1879a.
1880. *Tænia multiplex* Göze of Leuckart 1880b; this combination should be attributed to Leuckart 1852b.
1880. *T(ænia) visceralis; cerebrina* Küchenmeister 1880a.
1880. *Verm. vesical. socialis* (Bloch 1780a) Kuchenmeister 1880a.
1880. *Polycephalus granulosus* Zeder of Küchenmeister 1880a.
1880. *Cœnurus cerebralis* auct. of Moniez 1880a; this combination should be attributed to Rudolphi 1808a.
1882. *Tænia cœnurus* Sieb. of de Lanessan 1882a; this combination should be attributed to Bertolus et Chauveau 1879a.
1882. *Cœnurus scrialis* (Gervais 1847a) Perroncito 1882a; misspelling; misdetermination.
1882. *Cœnurus sœrialis* Gerv. of Perroncito 1882a; this combination should be attributed to Perroncito 1882a; misspelling; misdetermination.
1882. *Tænia cœnurus canis* Zürn 1882α.
1882. *Cœnurus cerebralis ovis* Zürn 1882α.
1882. *Cœnurus scrialis* Baillet of Zürn 1882α; this combination should be attributed to Gervais 1847a; misdetermination.
1882. *Cysticercus e Tænia cœnur.* Zürn 1882α.
1885. *Tænia cœnur. cerebralis* (Batsch 1786a) Reinitz 1885a.
1886. *T[ænia] cœnure* Brocchi 1886a.

1887. *Tenia cœunuruz* Besnard 1887a; misspelling. [Besnard 1887a is a review of Besnard 1886a, not available to me.]
1893. *T(œnia) cœnusus* Burch 1893α; misprint.
1894. *Polycephalus ovis* Braun 1894a.
1895. *Cenurus cerebralis* (Batsch 1786a) Armatage 1895.
1898. *Vermis vesicularis socialis* Bloch 1782 of Stiles 1898a; this combination should be attributed to Bloch 1780a.
1898. *C(enuro) cerebralis* (Batsch 1786a) Bosso 1898α.
1901. *C[ystotœnia] cœnurus* (Tschudi 1837a) Benham 1901a.
1901. *Tenia cœnurus* (Desmonceaux 1868a) Perroncito 1901a.
1901. *Tœnia cœnurus* Van Ben. of Vaullegeard 1901a; this combination should be attributed to (Tschudi 1837a) Küchenmeister 1853e.
1902. *Cœnurus cerebralis bovis* Mayr 1902a.
1903. *T(œnia) cœrunus* Buysson 1903α; misprint.
1903. *Cœnurus cerebrales* Law 1903a; misprint.
1904. "*T.* [*(Cystotœnia)*] *cœnurus* Küchenmeister of Leuckart 1853" of Stevenson 1904b; see Diesing 1863b.
1905. *Tœnia multiceps* (Zeder 1800) Rudolphi 1802 of Stiles and Stevenson 1905a; this combination should be attributed to Leske 1780a.
1905. *Hydatis cerebralis* (Batsch 1786a) Blumenbach 1816a of Stiles and Stevenson 1905a; this combination should be attributed to Virey 1798a.
1905. *Cœnurus cerebralis* (Batsch 1786a) Cuvier 1825a of Stiles and Stevenson 1905a; this combination should be attributed to Rudolphi 1808a; form intended, apparently, *Cœnurus cerebralis*.
1905. "*T.* [*(Cystotœnia)*] *cœnurus* Küchenmeister of Leuckart 1863" of Stiles and Stevenson 1905a; see Diesing 1863b.
1905. *Polycephalus cerebralis* (Batsch 1786a) Lœnnec 1812 of Stiles and Stevenson 1905a; this combination should be attributed to Lœnnec 1804a.
1905. "*Hidatula cerebralis* (Batsch) of Goldberg 1855a" of Stiles and Stevenson 1905a; see Diesing 1850a.
1905. *Multiceps socialis* (Batsch 1786a) Stiles and Stevenson 1905a.
1905. *Hydatigena socialis* Batsch 1786a of Stiles and Stevenson 1905a; this combination should be attributed to Stiles and Stevenson 1905a.
1905. *Cysticercus cœnurus* (Küchenmeister 1853) Koeberlé 1861a of Stiles and Stevenson 1905a; this combination should be attributed to (Tschudi 1837a) Koeberlé 1861a.
1905. *Tœnia cœnurus* (Küchenmeister 1853) v. Beneden 1861a of Stiles and Stevenson 1905a; this combination should be attributed to (Tschudi 1837a) Küchenmeister 1853e.
1905. *Cœncerus cerebratis* Vet. Ed. Amer. Sheep Breeder 1905∂; misprint.
1908. *Tenia cenurus* (Tellor 1879a) Germain 1908α.
1908. *Tœnia cerebrales* (Law 1903a) Luckey 1908α; misprint.
1909. *T(œnia) cœnurns* Braun 1909; in Braun u. Lühe 1909α; misprint.
1909. *Cœnurus cerebralis* Braun 1909; in Braun u. Lühe 1909α; misprint.
1909. *Tœnis cœnurus* (Tschudi 1837a) Hall 1909α; misprint.
1910. *Tœnia cœnuris* Kildee 1910α; misprint.

Acharius (1782) uses the form *T. vesicularis multiceps; Cerebrina.* As *Cerebrina* is substituted for *Multiceps*, used in generic sense in Goeze's (1782a) *Tœnia vesicularis, cerebrina; Multiceps*, it has been credited as an erroneous generic synonym.

In crediting the genus *Hydatis* to Virey (1798a), the prior use of the same word by Goeze (1782a) has been taken into consideration;

Goeze, however, does not use it generically, but merely as a common noun, hence this word as used by him has no standing in nomenclature. Stiles and Stevenson (1905a) in passing judgment on "*Hydatis* Goeze 1782a," given by them in the synonymy of *Echinococcus,* state in comment, "Very doubtful whether this is used in generic sense."

Goeze uses the word *Hydatis* to refer to water bladders, apparently considered as nonparasitic, found in animal bodies; in fact, uses it in just the sense in which Hippocrates and other Greeks used the same word "*ὑδατις*," meaning the same thing, a water bladder. Goeze denotes by it substantially the same things that are included in the genus *Acephalocystis* Lænnec (1804a), with the essential difference that the objects in question are not regarded as parasites, and hence, in this case, not as animals. Therefore the word has no more standing in nomenclature than the word "Wasserblase," which is regularly used as its equivalent. Larval cestodes are constantly referred to by Goeze in this work as "Eingeweidebandwurm" or "Blasenbandwurm," and the generic and specific names are summed up in a section which does not include the word *Hydatis* and which precedes any use of this word. The word *Hydatis* is used to denote an object which is compared to or contrasted with a "Blasenbandwurm." Thus he states that *Tænia hydatigena* is very similar to the "Wasserblasen (Hydatis)." Again, he states that the true water bladders—"die eigentlichen Wasserblasen (Hydatides)"—are very different from the bladders in which bladderworms, "Blasenwürmer," live. In his final use of the word he states that he found a bladder, "Blase," in the liver of a pig. He adds that it was no "Wasserblase oder Hydatis," for on opening it he found the worm in it. If *Hydatis* is a genus at all in Goeze's work, it is a genus of larval cestodes or "Blasenwürmer." The references show that it is specifically differentiated from such forms.

Sherborn (1902a) has also referred the genus *Hydatis* to Virey (1798a). Virey calls it a genus and appends the generic characters.

Sherborn (1902a) has listed *Vermis* as a genus of Bloch (1782a). Bloch's genus is *Vermis vesicularis,* with the three species *socialis, eremita,* and *teniæformis.* It therefore appears that the genus *Vermis* of Sherborn (1902a) must be regarded as an additional synonym of *Multiceps.*

The writer attributes the form *Tænia* (*Cystotænia*) *cœnurus* to Diesing (1863b), and *C*(*ystotænia*) *cœnurus* to Benham (1901a) for the reason that so far as can be determined, the forms in question are first used by these writers. Leuckart's (1863a) responsibility for the form *Cystotænia* ends with that form. The fact that he proposed this as a subgenus may be taken to imply its application to the forms falling within the definition of this subgenus, but such application involves a certain judgment of cases which we can not postu-

late as perfectly clear, and it is too much to suppose that Leuckart should be held responsible for any or all forms involving the name *Cystotænia* when it may be that a given form is based on a judgment or an error for which Leuckart would not care to be responsible. When a writer proposes a new genus or subgenus he has the option of also proposing the new combinations involved and assuming responsibility for them, or of leaving such an act and its responsibility to some one else and only assuming the responsibility for the genus or subgenus proposed.

The reason for crediting the use of *Cœnurus* to Schinz (see Cuvier 1825a) and not to Cuvier (1825a) is the same as the reason why *Tænia cerebralis* is credited to Gmelin (1790a) and not to Linnæus. Schinz has used here forms not used in the French edition of 1817 of which this is an emended translation, and it is obviously unfair to hold Cuvier responsible for forms not used in the original article.

MULTICEPS SERIALIS.

HISTORICAL SKETCH.

It has already been pointed out (p. 38) that Lænnec (1804a) stated that the gid parasite occurs in the sheep, the cow, and perhaps in the rabbit, and that this reference to the gid parasite in the rabbit appears to have been based on hunters' reports of gid in rabbits. It has also been stated that Cloquet (1818a) included the rabbit as a host of the gid parasite without reservation, but his statement appears to be based on Lænnec's (1804a or 1812a) article and is therefore of no value. Neither of these articles, then, can be considered as erroneous records of *Multiceps serialis* under the name of *Cœnurus cerebralis*.

The first record of *M. serialis* is that of de Blainville (1828a) who described a cyst, which he calls an *Echinococcus*, from the peritoneal cavity of a wild rabbit. He noted the serial arrangement of the heads, which afterwards was made the reason for the specific name, and thought that it might be a new species, or might be *E. veterinorum*. Despite de Blainville's decision that the form was probably *Echinococcus*, his article shows evidence of a misconception of that genus and of errors of observation, and it is quite certain that the parasite was *Multiceps serialis*. It is so considered by Gervais and van Beneden (1859b) and by Railliet (1882a).

M. serialis is a widely distributed form, long considered as *M. multiceps* or confused with that form by some writers. It is of less economic importance than *M. multiceps* owing to its occurring in the connective tissue and musculature of rodents instead of in the central nervous system of wild and domestic ungulates, as is the case with *M. multiceps*.

Five years after de Blainville's (1828a) record, Rose (1833a) noted *M. serialis* in rabbits in England and stated that warreners, before

sending affected rabbits to market, punctured the tumor caused by the parasite and squeezed out the fluid. Rose described the production of daughter vesicles by budding, but did not find this or any other feature a sufficient structural difference between this parasite and the gid parasite to warrant making a new species. Later, Rose (1844a) described a new case and discussed the cyst surrounding the parasite and the external budding of the latter.

Leblond (1837a) notes that Dr. Emmanuel Rosseau sent him a cyst a little larger than a nut from between the spinal membranes of a rabbit. Leblond identified the parasite as *Cœnurus cerebralis*.

Leblond's specimen was later examined by Gervais (1847a), who makes a new species of it on the basis of the serial arrangement of the heads and the long folded neck. From the first feature he named it *Cœnurus serialis*. Railliet (1889o) refers this name to an article in the Dictionnaire Universel d'Histoire Naturelle (v. 6,p. 729), under date of 1845. This reference is correct for the date 1861, but there appears to be no such reference for 1845, and it is possible that Railliet has erred in giving this date. Gervais calls his form *Cœnurus serialis* n. sp. in 1847, and it seems likely that this is the date of its first description. Stiles and Stevenson (1905a) appear to have followed Railliet in citing "*Cœnurus serialis* Gervais, 1847a, 98; probably 1845, 729, not accessible to us."

Baillet (1858b) produced the adult tapeworm in the dog by feeding the cœnurus from the rabbit, and described it but did not name it, as both the adult and larva seemed very similar to the corresponding forms of the gid parasite. Feeding experiments in which the attempt was made to infect rabbits and sheep with the proglottids of the adult tapeworm were not well carried out and showed nothing.

Later, Baillet (1863a) produced the tapeworm again and named it *Tænia serialis*. Proglottids with developed eggs were fed to rabbits and produced the cœnurus. Ten attempts to infect rabbits with the eggs of the adult *Multiceps multiceps* and five attempts to infect sheep with the eggs of the adult *Multiceps serialis* failed. Baillet gives a very full description of the adult and larval *M. serialis*.

Perroncito has stood out against the validity of this species. He records (Perroncito, 1875a) a cœnurus from a rabbit, and although he finds a yellow color present which he does not find in the cerebral cœnuri of ruminants, he nevertheless considers that all cœnuri arise from *Tænia cœnurus*. Later, Perroncito (1882a) finds the only difference between the rabbit and sheep cœnuri to be in the formation of daughter vesicles in the former, and still considers them the same species. At a quite recent date (Perroncito, 1901a), this opinion is still adhered to. The same opinion has been expressed even more recently by Friedberger und Fröhner (1904α).

A careful study of *M. serialis* was made by Reinitz (1885a), who concluded that Lindemann's (1867a) *Cœnurus lowzowi* was *M. serialis*, but that Boettcher's (1862a) *Cysticercus botryoides*, Pagenstecher's (1877a) cœnurus from *Myopotamus coypus*, and Mégnin's (1880d) *Cœnurus polytuberculosus* from *Dipus sagitta* were not.

Kunsemüller (1903a) has made an excellent comparative study of *M. serialis* and *M. cerebralis*.

Brandegee (1890a) records the parasite from the United States and notes that two species of rabbits were never found infected, though hundreds were examined, only the California hare being infected. She surmises that the wolf is a probable host, and the coyote, lynx, and fox possible hosts of the adult cestode.

THE HOSTS AND OCCURRENCES OF THE LARVAL MULTICEPS SERIALIS.

Inasmuch as the list of doubtful and erroneous records is very short, such cases are included here with the certain and probable cases and their standing given in the discussion. No attempt is made to distinguish between hares and rabbits in the following list. They are all listed as rabbits.

List of occurrences claimed for the larval Multiceps serialis.

Host.	Locality.	Authority.	Notes and comments.
Rabbit	France	De Blainville 1828a	One case.
Rabbit (*Lepus cuniculus*).	England	Rose 1833a	A number of cases implied.
Rabbit	France	Leblond 1837a	One case from vertebral canal.
Do	England	Rose 1844a	One new case.
Do	France	Gervais 1847a	Leblond's specimen described as a new species.
Do	do	Baillet 1858b	Produced adult worm in dogs.
Do	do	Baillet 1863a	Produced adult and larval worm by feeding; failed to infect sheep with eggs of *M. serialis* or rabbits with eggs of *M. multiceps*.
Squirrel	England	Cobbold 1864b	Host from America.
Rabbit	United States (?)	Valentin (date?)	Not seen; cited from Leuckart (1865a.)
Rabbit (*L. timidus*).	Russia	Lindemann 1867a	Described as *Cœnurus lowzowi;* not available; considered by subsequent writers as *M. serialis*.
Rabbit	France	Troisier 1874a	One case.
Do	do	Arloing [1875?]	Per Railliet 1882a; Arloing in Brunet 1875a does not claim to have found it.
Do	Italy	Perroncito 1875a	One case.
Do	England	Cobbold 1876b	Rose's specimens in Guy's Museum and some in Oxford collection.
Do	Scotland	do	One specimen in Cobbold's collection.
Do	France	Davaine 1877a	One case recorded and others claimed; specimen exhibited first shown by Bailly in 1861; claims that Prince has found this form in France.
Coypu (*Myopotamus coypus*).	Germany	Pagenstecher 1877a	From Berlin Zoological Gardens.
Rabbit	Italy	Perroncito 1878b	Listed from title; article not available.
Squirrel (*Sciurus vulpinus*?).	England	Cobbold 1879b	Same case as Cobbold (1864b).
Rabbit	England (?)	do	Note that Alston has found cœnurus in rabbit.
Klippdas (*Hyrax capensis*).	Not given	do	Error, due to confusing records of Gervais (1847a) and Pagenstecher (1877a).
Gray squirrel	United States	Stewart 1880a	Probably a reference to Cobbold's (1864b) case.
Rabbit	do	do	Claimed to occur; no cases or authorities cited.

List of occurrences claimed for the larval Multiceps serialis—Continued.

Host.	Locality.	Authority.	Notes and comments.
Squirrel (*Sciurus vulgaris*).	France	Cagny 1882a	One case.
Rabbit	do	do	One specimen exhibited by Railliet in discussion.
Do	Italy	Perroncito 1882a	Number of cases not given.
Do	Germany (?)	Brann 1885c	One specimen.
Do	Russia (?)	Reinitz 1885a	Three specimens studied.
Do	France	Railliet 1889n	One case.
Do	do	Railliet 1889o	Second spinal case; simultaneous connective tissue infection with 9 other cœnuri.
Rabbit	New Zealand	Thomas 1889a	Not available; cited from Braun (1894a).
Rabbit (*Lepus californicus*).	United States	Brandegee 1890a	Many cases in California; paper read in 1882.
Rabbit	France	Villain and Bascou 1890a.	Not available; cited from Morot (1900c); one case.
Do	do	Leclerc 1890a	Not available; cited from Morot (1900c); several cases.
Do	do	Railliet 1891i	One case; parasite lived over 2 years.
Rabbit (*L. variabilis*).	Russia	Voigt 1891a	One case.
Rabbit (*L. californicus* and *L. texianus*).	United States	Curtice 1892g	Number of cases not given; in Texas and California.
Rabbit	England	Robinson 1892a	One case; scolices with 6 suckers.
Do	Italy	Condorelli-Maugeri 1893a.	One case; under pericardium.
Do	Japan	Janson 1893c	One case; listed as *Cœnurus cerebralis*.
Do	France	Mégnin 1895	Not available; cited from Morot (1900c); several cases.
Do	do	Lucet 1897b	One case; 28 cœnuri.
Do	do	Vignon 1897a	Not available; cited from Morot (1900c), who considers Vignon's *Echinococcus* a cœnurus.
Do	United States	Ward 1897b	Common in Nebraska.
Horse	do	Stiles 1898a	Doubtful case, already noted under *M. multiceps*.
Rabbit	Italy	Bosso 1898a	One case.
Rabbit (*L. callotis*).	United States	Hassall 1898a	Specimens seen by Stiles or Hassall.
Rabbit (*L. cuniculus*).	Not North America.	do	Do.
Rabbit	France	Railliet 1899b	Specimen with many abnormal scolices.
Do	do	Morot 1900c	Four cases with 4, 11, 20, and 70 cœnuri, in each host; 1 in eye orbit.
Do	do	Gallier 1900a	One case.
Do	Siberia	Von Linstow 1901e	Four specimens in St. Petersburg museum.
Do	Italy	Parona 1902f	Two cases.
Do	France	Buysson 1903a	One case.
Rabbit (*L. cuniculus domesticus*).	Germany(?)	Kunsemüller 1903a	One case; specimen collected in 1874.
Rabbit	England	Byerly 1905a	One case.
Do	do	Jowett 1905β	Has found it.
Do	United States	Ransom 1905d	Specimen No. 1823 figured.
Do	Scotland	Taylor 1905a	Two cases.
Goat	India	Gaiger 1907a	Do.
Do	do	Holterbach 1907a	Note of Gaiger's (1907a) case.
Rabbit	Not given	do	Sic.
Cat	do	do	Sic; error.
Squirrel	do	do	Sic.
Sheep	do	do	Sic; error.
Horse	do	do	Sic.
Rabbit (*L. californicus*).	United States	S. E. Piper, in litt. Apr. 14, 1908.	In Nevada; several cœnuri fed to dog.
Rabbit	do	Curtice, in litt. July 26, 1909.	In Colorado and California in 1887 and 1888.
Goat	India	Dey 1909a	One case; cysts in brain and connective tissue.
Rabbit	Switzerland	Galli-Valerio 1909a	One case; 1 specimen showed 6 suckers.
Do	England	Gray 1909a	Has seen it in eye orbit.
Do	France	Henry 1909a	Cœnurus attained volume of 800 c. c.
Do	New South Wales.	Johnston 1909a	Listed.
Rabbit (*Oryctolagus cuniculus*).	Victoria(?)	Sweet 1909a	One case.
Rabbit	United States	Dr. Young in litt. Oct. 9, 1909.	In North Dakota.
"Sage rabbit"	do	Thos. Large, in litt. Jan. 6, 1910.	In Idaho.
Rabbit	United States	Hall 1910β	This article.

The following specimens of *M. serialis* from the United States are available to the writer.

Host.	Locality.	Collector and date.	Collection.
Lepus californicus	California	Curtice 1890	B. A. I. coll. No. 1823.
Lepus sp	(?)	(?) 1894	B. A. I. coll. No. 1826.
Lepus callotis	New Mexico	Townsend 1896	B. A. I. coll. No. 2798.
Lepus sp	(?)	(?)	B. A. I. coll. No. 2608.
Do	Michigan	Hayward 1904	B. A. I. coll. No. 3948.
Lepus californicus	California	Adams 1905	B. A. I. coll. No. 3889.
Lepus c. walla-walla	Oregon	Piper 1907	B. A. I. coll. No. 14728.
Do	do	do	B. A. I. coll. No. 14729.
Do	do	do	B. A. I. coll. No. 14730.
Lepus sp	Nevada	Hall 1910	B. A. I. coll. No. 15599.
Do	Nebraska	Young 1905	Coll. Hall.

The first of the above lists shows that *Multiceps serialis* has been claimed to occur in the hare, rabbit, squirrel, coypu, goat, horse, klippdachs, sheep, and cat. Records of its occurrence in the hare and rabbit are undoubtedly correct, the records from the squirrel are probably correct, those from the coypu and goat may be correct, the record from the horse is doubtful, as heretofore indicated, and those from the hyrax, sheep, and cat are errors.

Cobbold (1864b) found a cœnurus in an American squirrel, *Sciurus vulpinus*?, which he thought might be the same species that Rose (1833a) found in "bladdery rabbits." This conclusion appears to be substantiated by the subsequent finding by Cagny (1882a) of a cœnurus in a squirrel, *Sciurus vulgaris*, which had been caught young and kept three years. Cagny's specimen was examined by Mégnin and Railliet who pronounced it *Cœnurus serialis*. Kunsemüller (1903a) thinks Cobbold's cœnurus may be *C. serialis*. If these authorities are right in their identification of this parasite, its rarity in this host is to be expected, as the squirrel's food is of such a nature, consisting as it does largely of nuts, that fecal contamination by carnivorous hosts of the adult worm would only occur very rarely.

Stewart (1880a) writing from the United States, says: "The presence of this parasite [*Cœnurus cerebralis*] has been discovered in the liver of our gray squirrel and in rabbits, as well as in numerous sheep in this country." It is probable that the allusion to the parasite from the squirrel is a reference to Cobbold's (1864b) case of a cœnurus in an American squirrel. The reference to cœnurus forms having been found in American rabbits seems likely enough from our knowledge of the common occurrence of *M. serialis* in this country, but Stewart's record is uncertain, as he does not claim to have seen such a parasite, nor does he cite anyone who has.

Lindemann (1867a), according to a review by Rudnew (Lindemann 1868b), described a *Cœnurus lowzowi* from the rabbit in Russia, in an article not available to the writer. This has since been very generally regarded as *C. serialis* by helminthological writers, among

whom are Pagenstecher (1877a), Moniez (1880a), Braun (1897a), and Kunsemüller (1903a). The review of 1868 says there were no hooks in this form but other writers say the hooks were all the same size. Pagenstecher (1877a) says they were all the same size and finds the same thing in one scolex of his cœnurus from *Myopotamus coypus*. Moniez (1880a) says the same and considers it either an error in observation or a teratological fact. Railliet (1899b) has found a great number of abnormalities in *Multiceps serialis*. In view of this fact and the unanimity of opinion concerning this form it has been accepted here as *M. serialis*.

Pagenstecher (1877a) describes a cœnurus which he identifies as *Cœnurus serialis* from the neck of *Myopotamus coypus*. Reinitz (1885a) and Braun (1897a) think this form from the coypu is not *M. serialis*. Moniez (1880a) and Railliet (1882a) accept it as *M. serialis*, and Kunsemüller (1903a) states that he agrees with Moniez and Railliet and disagrees with Reinitz and Braun. In view of this disagreement, the form is provisionally accepted as *M. serialis*, as originally described.

Cobbold (1879b) has the following:

> The klipdas or dasse (*Hyrax capensis*) is infested by a tapeworm. * * * Under the name of *Cœnurus serialis* a larval cestode has been described by Gervais, the same parasite being called *Arhynchotænia critica* by Pagenstecher ("Zur Naturgeschichte der Cestoden." * * *).

In the index this appears as "*Cœnurus serialis* of the hyrax."

Cobbold is in error in stating that Gervais described *Cœnurus serialis* from the hyrax. As has been pointed out, his specimen was from the rabbit. Moniez (1880a) notes that Cobbold has confused Pagenstecher's (1877a) statements, and Railliet (1882a) has stated that Cobbold has listed *C. serialis* from *Hyrax capensis* as a result of some confusion.

Gaiger's (1907α) and Dey's (1909α) records of *M. serialis* from the goat in India are provisionally accepted; a more extended discussion of these and other forms will be given in a subsequent paper dealing in part with the morphology of *Multiceps spp.* Holterbach's review of Gaiger's (1907β) paper contains a number of errors in the list of hosts of *M. serialis*.

The list of occurrences shows that the parasite has been reported from France, England, Scotland, Italy, Russia, Siberia, Switzerland, Australia, New Zealand, Japan, India, and the United States. Whether the parasite occurs in Germany is doubtful. Pagenstecher's (1877a) cœnurus was collected from a coypu in the Berlin Zoological Garden, and hence the origin of the parasite is in doubt. Reinitz (1885a) does not state where his three specimens were collected, but says that one was the specimen discussed by Braun (1883c) before the Dorpat Naturforscher Gesellschaft and the other two

were from Prof. Semmer. Braun (1883c) says of the specimen mentioned that he owes it to "dem Herrn. stud. med. Hasenjäger," from which it would appear that it was collected in Germany. Later, however, Braun (1897a) lists the parasite from Russia on the authority of Reinitz (1885a) and Voigt (1891a), but in giving the distribution of this form he does not mention Germany. Still later, Braun (Braun u. Lühe, 1909α), writing of the tapeworms of the domestic animals, refers to "Die in Deutschland noch nicht wohl aber in Frankreich beobachtete und sicher auch in Russland bei Hunden workommenden *T. serialis* Baill." On the face of it, this statement can hardly be taken to mean more than that the adult *T. serialis* has not yet been observed in dogs in Germany, and Braun's English translator (Braun u. Lühe, 1910α) does not seem to have sufficient reason, especially as regards Germany for the statement that "*T. serialis* Baill. * * * occurs in dogs in France, and probably also in Russia, though not in Germany." Kunsemuller (1903a) does not give any locality for his specimens.

The common occurrence of *M. serialis* in rabbits in the western part of the United States makes it unlikely that this parasite was imported into this country from the Old World, while its wide distribution abroad and its apparent absence from the eastern part of this country makes it equally unlikely that it was carried abroad from this country. Its presence in Oregon and in Siberia points to the strong possibility of its having spread by way of far northern routes over its present wide range of distribution.

M. serialis has been recorded from the vertebral canal by Leblond (1837a) and Railliet (1889o), in the latter case with an accompanying infection of the more usual connective-tissue locations. It has been recorded from the pericardium once by Condorelli-Maugeri (1393a), from the eyelid by Byerly (1905α), and from the orbit of the eye by Gray (1909α), and by Mr. S. E. Piper of the Bureau of Biological Survey of the Department of Agriculture in data furnished the writer.

The number of parasites varies from one, a very common record. to 70 in one case of Morot (1900c), and in size the cyst may attain a volume of 800 c. c., as in the case of Henry (1909α). The parasite may live over two years according to Railliet (1891i). Abnormal specimens have been noted by Pagenstecher (1877a) from the coypu, by Robinson (1892a), Railliet (1899b), and Galli-Valerio (1909α), from the rabbit, and Lindemann's (1867a) specimen was probably such.

Successful operations for the parasite have been noted by Railliet (1889n) and Byerly (1905α).

Mr. Piper, who has furnished the Bureau collection with specimens as noted above, has also furnished us data stating that the

parasite was found in 7 out of 12 rabbits examined in Oregon, a pint of cysts being taken from the peritoneal cavity of one. Mr. Piper also collected *M. serialis* in Nevada in 1908, as noted in the table, and fed a number to a dog. The dog was shipped to this laboratory, but did not develop the adult parasite, probably owing to diarrhea resulting from intestinal irritation by too many scolices. The writer has since collected *M. serialis* in Nevada, and developed the adult worm by feeding scolices to a dog. Mr. Graybill, of this laboratory, has also collected *M. serialis* in Texas and fed it to a dog. Doctor Young, of the University of North Dakota, writes under date of October 9, 1909, that there is a specimen in the university collection, unlabeled, and that rabbits which appear to be infected are seen in North Dakota; he himself has seen such a rabbit. Doctor Shantz, of the Bureau of Plant Industry, has seen such rabbits in Kansas and Colorado, and Mr. E. F. Chilcott of the same Bureau says they are common in South Dakota.

Kaupp's (1910α) statement that *M. serialis* is not common in the United States is hardly accurate. In certain Western States it is very common.

The occurrence of the larval parasite in the muscles of its host, especially in the leg muscles, a common site, and its occurrence in such relatively enormous sizes, numbers, or quantities as are given in the more extreme cases of Henry (1909α), Morot (1900c), and Mr. Piper, may be looked upon as an adaptation favorable to the parasite, serving to impede the locomotion of the secondary host and so increase the likelihood of its being captured by some carnivore which may serve as the primary host of the parasite. Brandegee (1900a) has also pointed out the presence of an adaptation here.

THE OCCURRENCES OF THE ADULT MULTICEPS SERIALIS.

The dog is the only host in which the adult *Multiceps serialis* has been found or produced. Thomas's (1889a) attempts to infect cats and ferrets by feeding them the larval cestodes failed, according to Braun (1894a), and a surmise such as that of Brandegee (1890a) that the wolf, coyote, lynx, and fox may act as hosts, has, of course, only the value of a surmise. At the same time, Baillet (1866b) early called attention to the fact that the larval parasite was found in the wild rabbit more commonly than in the domestic rabbit, and surmised that the usual host was some wild carnivore.

Galli-Valerio (1909α) failed to develop the adult worm on ingesting two living heads from the larval parasite. The writer also has similarly failed to develop the adult worm on ingesting three living heads from the larval parasite.

List of occurrences of the adult Multiceps serialis in the dog.

Locality.	Authority.	Notes and comments.
France	Baillet 1858b	By experiment.
Do	Baillet 1863a	Do.
Do	Baillet 1866b	Found several times.
Do	Bertolus and Chauveau 1879a.	One case in a cosmopolitan "dog of the regiment."
Italy	Perroncito 1878a	Not available; based on Railliet's (1882a) statement that Perroncito failed to infect sheep from *Cœnurus serialis*.
Do	Perroncito 1882a	By experiment.
New Zealand	Thomas 1889a	Not available; cited from Braun (1894a); by experiment.
France	Neumann 1892a	Several times.
Japan	Janson 1893c	By experiment.
France	Railliet 1893a	By experiment; claimed that Neumann has also produced it; I can not verify claim.
North America	Ward 1895b	Listed.
Do	Sommer 1896c	Stated on the authority of Stiles.
United States	Ward 1897b	One case out of 20 dogs in Nebraska; others implied.
Do	Stiles 1898a	Parasite seen by Stiles.
Do	Stevenson 1904b	Two cases out of 35 dogs in Nebraska; 20 specimens.
Australia	Cobb 1905a	One specimen; identification not positive.
United States	Ransom 1905d	Specimen No. 2839 figured.
India	Gaiger 1907*a*	By experiment.
New South Wales	Johnston 1909*a*	Rare.
United States	Hall 1910*β*	This article.

ECONOMIC IMPORTANCE.

As has been stated, *Multiceps serialis* is of comparatively little economic importance. It deserves attention from an economic standpoint largely because some scientists, especially the Italian, insist on identifying it with the highly important *M. multiceps*.

Rose (1833a) states, as before mentioned, that when warreners meet with infested rabbits they puncture the bladder, squeeze out the fluid and send the animal to market. According to Martel (1909*α*), this custom of puncturing through the skin of infected rabbits is still in vogue in France. While the idea of eating the parasite is not a pleasing one, the danger from doing so is negligible as the parasite is apparently not transmissible to man, as Galli-Valerio's (1909*α*) and the writer's experiments along this line indicate. Moreau (1909*α*) in a note on abattoir inspection in France, lists muscular cœnurosis of hares and rabbits as sufficient cause for total condemnation of the carcass, but probably this practice would only be followed in such cases as those listed by Morot (1900c), where rabbits were condemned owing to infestation with 11, 20, and 70 cœnuri each. In Morot's cases, a rabbit infested with only 4 cœnuri was returned for food after the removal of the diseased parts. The writer finds that in the western United States the carcasses of rabbits infected with *M. serialis* are thrown away as unfit for food.

SYNONYMY.

The generic synonymy has already been given under *Multiceps multiceps*.

Species MULTICEPS SERIALIS (Gervais 1847a) Stiles and Stevenson 1905a.

1828. *E* [*chinococcus*] *veterinorum*(?) of de Blainville 1828a; misdetermination.
1833. *Cœnurus cerebralis* Lamarck and Rudolphi of Rose 1833a; this combination should be attributed to Rudolphi 1808a; error; misdetermination.
1837. *Cœnurus cerebralis* of Leblond 1837a; error; misdetermination.
1844. *Cœnurus cerebralis* of Rose 1844a; misdetermination.
1847. *Cœnurus serialis* Gervais 1847a.
1855. *Cœnurus serdalis* Gervais of Goldberg 1855a; in synonomy of *Tænia cœnurus;* this combination should be attributed to Goldberg 1855a; misprint.
1863. *Tænia serialis* (Gervais 1847a) Baillet 1863a; first naming of strobila form.
1863. *Cœnurus cerebralis*? *leporis cuniculi* Baillet of Diesing 1863b; in synonomy of *Tænia cœnurus;* not at present available, cited from Diesing 1864a, identical; this combination should be attributed to Diesing 1863b.
1863. *Tænia cœnuri cuniculi* Baillet of Diesing 1863b; in synonomy of *Tænia cœnurus;* this combination should be attributed to Diesing 1863b.
1864. *Cœnurus cuniculi* (Diesing 1863b) Cobbold 1864b; name taken from MSS. of Rose.
1867. *Cœnurus lowzowi* Lindemann 1867a; not available, cited from Lindemann 1868b; same form used once by Braun 1894a.
1868. *Tænia cœnurus* of Cobbold 1867a; error.
1877. *Cœnurus lowtzowi* Lindemann of Pagenstecher 1877a; this combination should be attributed to Pagenstecher 1877a; misspelling.
1877. *Cœnurus nov. spec.* of Pagenstecher 1877a; Pagenstecher refers thus to the form which he identifies as *Cœnurus serialis.*
1877. *Cœnurus scrialis* Gervais of Davaine 1877a; this combination should be attributed to Davaine 1877a; misspelling.
1877. *Tæniaserialis* Baillet of Davaine 1877a; space omitted.
1879. *Arhynchotænia critica* Pagenstecher of Cobbold 1879b; error.
1882. *Cœnurus serialis* (Gervais 1847a) Perroncito 1882a.
1882. *Cœnurus saerialis* Gervais of Perroncito 1882a; this combination should be attributed to Perroncito 1882a; misspelling.
1882. *Cœnurus serialis* Baillet of Zürn 1882*α*; this combination should be attributed to Gervais 1847a.
1889. "*Cœnurus spec.*? Pagenstecher . . . non *Coen. serialis* Gerv." of von Linstow 1889a.
1894. *Tænia echinococcus* of Herff 1894b; misdetermination.
1897. *Cœnurus lowzowii* Braun 1897a; misspelling.
1897. *Cœnurus lowtzowii* Braun 1897a; misspelling.
1898. *Cenuro serialis* (Gervais 1847a) Bosso 1898*α*.
1900. *Taenia* (*Caenurus*) *socialis* (Bloch 1780a) Gallier 1900a; error.
1901. *C*[*ystotaenia*] *serialis* (Gervais 1847a) Benham 1901a.
1901. *Coenurus serialis* Baill. of Gamble 1901*α*; this combination should be attributed to Gervais 1847a.
1901. T[*aenia*]*serialis* Ball. of Gamble 1901*α*; misprint for Baill.
1901. *Caenurus saerialis* Gervais of Perroncito 1901a; this combination should be attributed to Perroncito 1882a.
1901. *Tenia serialis* (Gervais 1847a) Perroncito 1901a.
1901. *T*[*ænia*] (*Coenurus*) *serialis* Gervais of Vaullegeard 1901a; this combination should be attributed to (Gervais 1847a) Vaullegeard 1901a.
1903. *Tœnia serialis* (Gervais 1847a) Thierry 1903a.

1905. *Cœnuri cuniculi* (Diesing 1863b) Byerly 1905γ; plural.
1905. *Cœnurus serialias* Byerly 1905γ; misprint.
1905. *Cœnurus cerialis* Byerly 1905γ; misprint.
1905. *Cœnurus scrialis* (Gervais 1847a) Davaine 1877a of Stiles and Stevenson 1905a; Davaine 1877a is responsible for specific name; *scrialis* is not Gervais 1847a.
1909. *Cysticercus serialis* (Gervais 1847a) Gray 1909α.
1909. *Tænia serialis* Bailet of Sweet 1909α; misprint for Baillet.
1910. *Cœnurus serialis* Gervals of Johnston 1910α; misprint for Gervais.

Herff's (1894b) statement that *Tænia echinococcus* is very common in the muscles of the jack rabbit in Texas may be considered as probably erroneous. Sommer (1895b) says of this: "Herff must, beyond question, refer to *Cœnurus serialis*." Stiles also, in his review of Herff (1895a), states that this is probably *C. serialis*. Herff's (1895b) later statement that the parasite was a "Compound cyst with tænia heads attached to the walls, or sometimes only hooklets floating in the liquid of the cysts," and his statement that the tapeworm, which he calls *T. echinococcus*, from the dog, was not more than one inch long, are not convincing. So far as available records show, *T. echinococcus* is very rare in the rabbit, and the fact that Herff finds a parasite very common in this host is itself evidence that the parasite was probably not an echinococcus. On the other hand, *M. serialis* is very common in the muscles of rabbits in the United States, and has been reported from Texas. The weight of evidence favors the idea that Herff's "compound cyst" was *M. serialis*. For this reason *Tænia echinococcus* of Herff (1894b) is included as a synonym of *Multiceps serialis*.

MULTICEPS LEMURIS.

HISTORICAL SKETCH.

Cobbold (1859d) described a cœnurus from the liver and thorax of *Lemur maco*. (Von Linstow (1878a) has corrected this host name to read *Lemur macaco*.) Later Cobbold (1861e) named this parasite *Cœnurus lemuris*. In macroscopic appearance it does not resemble *M. multiceps* or *M. serialis*, and from the host and location it is more reasonable to accept it as a new species than to attempt to refer it to either of the two species mentioned. It has been listed as certainly or probably distinct by Diesing (1864a), von Linstow (1878a), Railliet (1882a), and Kunsemüller (1903a). On the other hand Moniez (1880a) thinks this form probably belongs with Pagenstecher's (1877a) cœnurus from *Myopotamus coypus* as a specimen of *Multiceps serialis*, and Pagenstecher also states this as probable.

SYNONYMY.

Species MULTICEPS LEMURIS (Cobbold 1861e) Hall 1910β.

1861. *Cœnurus lemuris* Cobbold 1861e.
1880. *Cœnurus lemuri* Cobbold of Mégnin 1880p; this combination should be attributed to Mégnin 1880p; misspelling.

1880. *Cœnurus lemuri* Cobblod of Mégnin 1880p; this combination should be attributed to Mégnin 1880p; misprint for Cobbold.
1894. *Cœnurus lemoris* Cobb. 1861 of Braun 1894a; this combination should be attributed to Braun 1894a.

MULTICEPS POLYTUBERCULOSUS.

HISTORICAL SKETCH.

Mégnin (1879d) describes a cœnurus from the leg of the jerboa (*Dipus sagitta*). The following year Mégnin (1880d) named it *Cœnurus polytuberculosus* and published a more adequate description. From the structure of the opaque, tuberculate external coat and of the hooks it seems reasonably certain that this form must be retained as a distinct species. Reinitz (1885a) and Braun (1897a) agree that this parasite is not *M. serialis*, and Kunsemüller (1903a) does not think it likely.

SYNONYMY.

Species MULTICEPS POLYTUBERCULOSUS (Mégnin 1880d) Hall 1910β.

1879. "Cœnure polytuberculeux" of Mégnin 1879d.
1880d. *Cœnurus polytuberculosus* Mégnin 1880d.
1894. *Cysticercus polytuberculosus* Mégnin [1880d] of Braun 1894a; this combination should be attributed to (Mégnin 1880d) Braun 1894a.
1903. *Cœnurus tuberculosus* Mégnin of Kunsemüller 1903a; this combination should be attributed to Kunsemüller 1903a.

MULTICEPS SPALACIS.

HISTORICAL SKETCH.

Note has already been made of Diesing's (1850a) cœnurus "ex *Ipalacis capensis*," tentatively considered as *Cœnurus cerebralis* by Diesing. In a later article Diesing (1864a) corrected the host name to *Spalax capensis* and gave a general description, of which the only fact of interest is the occurrence of a single circlet of hooks. Such a feature was mentioned by Lindemann (1867a) as occurring in his *Cœnurus lowzowi* and was found once by Pagenstecher (1877a) in his *M. serialis* from *Myopotamus coypus*. The location of the parasite is not given, nor are there any other data of value in species determination, so in the absence of other similar records from this host the species is retained on Diesing's determination and under the name given by Moniez (1880a).

A discussion as to the probable host has already been given on p. 40.

SYNONYMY.

Species MULTICEPS SPALACIS (Moniez 1880a) Hall 1910β.

1850. *Cœnurus* Diesing 1850a.
1878. *Cœnurus spec.?* of von Linstow 1878a.
1880. *Cœnurus spalacis* Moniez 1880a.
1902. *Cœnurus spalacis* Dies. of von Linstow 1902q; this combination should be attributed to Moniez 1880a.

CYSTICERCUS BOTRYOIDES (species inquierenda).

HISTORICAL SKETCH.

Boettcher (1862a), according to Braun (1894a), describes a *Cysticercus botryoides* from the back muscles of a rabbit. The form is said to apparently arise by budding from a parent vesicle. It has been considered as *Cœnurus serialis* by Railliet (1882a). Reinitz (1885a) does not consider it as *M. serialis*, owing to differences in macroscopic appearance and hook form. Von Linstow (1878a) lists it as "*Cœnurus spec.*? (*Cœnurus cerebralis* Rud.?)." Leuckart (1865a) says that since the size, form, and number of the hooks agree with those of *Cœnurus* [species not specified] there are no grounds for making a new species. Braun (1897a) doubts whether this was a cœnurus at all, and considers it a budding cysticercus, and Kunsemüller (1903a) agrees with Braun. Inasmuch as the original description is not available, and the authorities cited disagree as to the identity and even as to the generic position of this form, it has been retained here under the original name as a species inquierenda.

SYNONYMY.

Species CYSTICERCUS BOTRYOIDES Boettcher 1862a.

1862. *Cysticercus botryoides* Boettcher 1862a; not available; cited from Braun 1894a.
1889. *Cysticercus botryoides* Reinitz of von Linstow 1889a; this combination should be attributed to Boettcher 1862a.
1889. *Cœnurus spec.* Boettcher of von Linstow 1889a.
1896. *C[œnurus] botryoides* Böttcher of Braun 1896d; this combination should be attributed to (Boettcher 1862a) Braun 1896d.

ACEPHALOCYSTIS OVIS TRAGELAPHI (species inquierenda).

HISTORICAL SKETCH.

Cobbold (1861e), in a list of entozoa, lists *Acephalocystis ovis tragelaphi* from *Ovis tragelaphus*, with the following note: "A solitary specimen filled with clear serous fluid. Probably an aborted Cœnurus. Spherical; 1 inch in diameter."

In the absence of any morphological characteristics which could possibly relate this specimen to the genus *Multiceps*, and with no statement as to the location on which to base even a surmise as to the likelihood of its being a cœnurus, it would be useless to pass judgment on this specimen.

SYNONYMY.

ACEPHALOCYSTIS OVIS TRAGELAPHI Cobbold 1861e.

1861. *Acephalocystis tragelaphi* Cobbold 1861e.

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