A Monograph on the Species and Distribution of the Genus Peripatus (Guilding).

By

Adam Sedgwick, M.A., F.R.S.,
Fellow of Trinity College, Cambridge.

With Plates XXXIV to XL.

INTRODUCTION.

The editors of the posthumous memoir of Professor F. M. Balfour on the anatomy and development of Peripatus capensis stated, in a note at the end of the memoir, their intention of preparing a complete monograph of the known species of Peripatus. This intention has at length been carried out, and the present monograph is the result of a laborious examination of all the specimens of Peripatus to which it has been possible to get access.

To my great regret Professor Moseley has been obliged, by his most unfortunate illness, to withdraw from active participation in the work; and the whole responsibility for the statements and descriptions falls upon me alone. But he has given me much valuable assistance, and has made some substantial contributions to the monograph. The most important of the latter relate to Peripatus novae-zeelandiae. He examined this species with great care, and the drawings from which figs. 16, 17—20, and 30 were copied, were executed under his supervision.

The material at my disposal has been as follows:

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1. The material left by Professor Balfour. This comprised a large number of the Cape species collected by Mr. Lloyd Morgan and by the late Mr. Oakley of the South African Museum, and some specimens of the New Zealand species collected by Professor Moseley and Professor Jeffrey Parker. Balfour also had fourteen specimens from Caracas, sent him, I believe, by Professor Ernst, and one specimen from South Africa, of the exact locality of which I am ignorant, with twenty-two pairs of legs. This specimen was found by Mr. Mansel Weale, and given to Balfour by Mr. Wood Mason.

2. A large number of specimens from the Cape, collected partly by myself in 1883, and brought to England alive, and partly by Mr. C. Stewart, of the Royal Hotel, Wynberg, who in the winters of 1884-85 sent me a large additional supply of live animals collected on Table Mountain. I am under great obligations to Mr. Stewart; not only for these specimens, but for the great help which he gave me when I was at the Cape.

3. A large number of living specimens from Wellington, New Zealand. These are the only specimens of this species which have ever been brought to England alive, and I owe them to the kindness of two gentlemen, who were personally unknown to me until they began to help me in my Peripatus work. Mr. Noel Barraud, of Wellington, at the request of my friend Mr. G. E. Anson, M.A., of Trinity College, began to hunt for Peripatus, and was successful in finding them. His specimens were, after two unsuccessful attempts, brought to England alive by Mr. Edgar J. Evans, chief officer of the Shaw, Savill, Albion Company's magnificent steamer "Tainui." The first two lots all died soon after leaving Rio Janeiro, but in the third attempt Mr. Evans was successful in finding a place near the cold chamber, where the temperature in the tropics was not too high for the animals. Since the third attempt Mr. Evans has been successful every voyage. My most sincere thanks are owing to both of these gentlemen, who, though not specially interested in natural history, have put themselves to
very considerable trouble and inconvenience to satisfy what would have seemed to most people an absurd whim of a perfect stranger. The living animals brought by Mr. Evans have enabled me to give a much more complete account of the New Zealand species than if I had had to rely only on the somewhat shrunk and contracted specimens in Balfour's material; and the embryos found in them are now being used by Miss Sheldon (No. 45), of Newnham College, who is engaged in preparing a memoir of their development.

4. Several specimens of the neotropical group of species from the Museum of Copenhagen, most kindly sent to me by Professor Steenstrup, in response to the appeal for specimens at the end of Balfour's posthumous memoir.

5. Dr. J. Kennel, of Würzburg, was kind enough to send me, in exchange for two living specimens of Capensis, two specimens of the smaller species, which he found in Trinidad.

6. Four specimens from near Williamstown, South Africa, belonging to the Indian Museum.

7. All the specimens in the British Museum. These have not, unfortunately, been of so much use to me as I had hoped, on account of their small number and contracted condition, and of the difficulty of getting a sufficiently strong light in the rooms set apart for the examination of spirit specimens in the British Museum, for the minute examination which is required. I am greatly indebted to Professor Jeffrey Bell, of the British Museum, for his courtesy in giving me every facility in his power to examine the specimens.

8. Two specimens from Queensland, Australia, belonging to Professor Jeffrey Bell. He has been most kind in putting them entirely at my disposal for the purposes of this monograph.

9. About twenty specimens from Demerara, brought alive to England by Mr. W. L. Sclater. Mr. Sclater has himself given a short description of these specimens, and has kindly placed the greater number of them at my disposal for the purposes of this monograph. These specimens were all killed
and opened by me shortly after their arrival in order that their embryos might be cut out and preserved. The result is that they are somewhat contracted and not so favorable for observation as they would have been had they been drowned.

Of the figures illustrating this monograph, the beautiful drawings of Capensis on Pl. XXXV, of Edwardsii, Moseleyi, and Novae-zealandiae on Pl. XXXVII, were made by Miss A. B. Balfour in Professor Balfour's lifetime and under his direction. The figures on Pl. XXXVI were made by Miss Balfour after her brother's death. To enable me to complete the illustrations required and to assist in the publication of the monograph, the Government Grant Committee of the Royal Society granted the sum of £50. Figs. 16, 17—20, and 30 were made at Oxford by Mr. W. H. Hill, under Professor Moseley's direction and supervision. The remainder of the drawings, including that of the living animal of Pl. XXXIV, were made by Mr. E. Wilson, of the Cambridge Scientific Instrument Company. My best thanks are due to these gentlemen for the care and skill with which they have executed their work.

Finally, I have again to acknowledge my indebtedness to Professor Jeffrey Bell for his assistance in preparing the Bibliography. Several papers which had escaped my notice were first pointed out to me by him.

For an account of the general anatomy and characters of the genus Peripatus, I must refer to the memoirs of Moseley (No. 18), Balfour (No. 28), and Gaffron (Nos. 34, 35). In this monograph only those features of a specific differential value are dwelt upon. I have, however, made a partial exception to this rule in the case of Capensis, the external characters of which have been described at considerable length. The reader will be able to gather from this description a sufficient knowledge of the general external features of the genus to enable him to understand the short descriptions of the other species.
The chief result of my observations has been to establish a definite series of characters which distinguish quite sharply all the species found in one region of distribution from those found in the others. Excluding the doubtful case of the Sumatran species, Peripatus has been found in the Ethiopian region (South Africa), the Australasian, and the Neotropical regions, and in each of these regions the genus is represented by more than one species. I have been able to establish a certain number of new species, but on the whole I must confess to failure in this respect. My failure chiefly relates to the species from the Neotropical region, and is due to the insufficient number of specimens at my disposal. It is remarkable of the species from this region that the number of the walking legs varies considerably within the same species, and it is only possible to determine the limits of the variation by examining a large number of individuals. Inasmuch as the specific characters other than those afforded by the legs are extremely inconspicuous, the importance of having a large and well preserved material is obvious—large in numbers to enable one to establish the limits of leg variation, and well preserved that the more minute specific differences may be made out.

How inconspicuous the specific characters are is well shown by contrasting the South African species Capensis and Balfouri. That these are distinct species is proved by the fact that the number of legs is constant in all the large number of specimens examined, and by the fact that it is preserved in the reproduction of the species. Embryos removed from *P. capensis* have invariably seventeen pairs of legs, while embryos removed from *P. Balfouri* have invariably eighteen pairs. The other differences relate simply to the texture and tint of the skin, and are so minute as to escape any but the experienced eye.

Before concluding this introduction, I am desirous of pointing out how extremely loose and inaccurate have been the observations of some professed zoologists on the members of our genus. In several cases has it happened that the observer (sit venia verbo) has not been at the trouble of counting the
legs of his specimens, though he has not refrained from making statements on this point, and in more than one case the number of legs in the specimen figured does not correspond with the author’s statement in the text. If one may draw conclusions as to these zoologists’ ideas of accuracy in observation from such instances in which only the most obvious external features are concerned, one would be inclined to infer that but little value can be attached to their statements with regard to the more inconspicuous details, which require some nicety of observation.

**Peripatus,** Guilding.

Soft-bodied vermiform animals, with one pair of ringed antennae, one pair of jaws, one pair of oral papillae, and a varying number of claw-bearing ambulatory legs. Dorsal surface arched and more darkly pigmented than the flat ventral surface. Skin transversely ridged and beset by wart-like spiniferous papillae. Mouth anterior, ventral; anus posterior, terminal. Generative opening single, median, ventral, and posterior. One pair of simple eyes. Brain large, with two ventral hollow appendages; ventral cords widely divaricated, without distinct ganglia. Alimentary canal simple, uncoiled. Segmentally arranged, paired nephridia are present. Body cavity is continuous with the vascular system, and does not communicate with the paired nephridia. Heart tubular, with paired ostia. Respiration by means of tracheæ. Dioecious; males smaller and generally less numerous than females. Generative glands tubular, continuous with the ducts. Viviparous. Young born fully developed. They shun the light, and live in damp places beneath stones, leaves, and bark of rotten stumps. They eject when irritated a viscid fluid through openings at the apex of the oral papillæ.

**Distribution:** South Africa, New Zealand, and Australia, South America and the West Indies [and in Sumatra?].

The genus *Peripatus* was established in 1826 by Guilding (No. 1), who first obtained specimens of it from St. Vincent
in the Antilles. He regarded it as a Mollusc, being no doubt deceived by the slug-like appearance given by the antennæ. Specimens were subsequently obtained from other parts of the Neotropical region and from South Africa, and the animal was variously assigned by the zoologists of the day to the Annelida and Myriapoda (vide Moseley, No 22, and Sclater, No. 41). Its true place in the system, as a primitive member of the group Arthropoda, was first established in 1874 by Moseley (No. 18), who discovered the tracheæ. It was reported from Australia in 1869 by Saenger (No. 15), and from New Zealand by Hutton (No. 19) in 1876. The nephridia were first discovered by Saenger (No. 15), but they were re-discovered and more fully described by Balfour (Nos. 21 and 28). Gaffron was the first to observe the cardiac ostia and the cilia in the generative tracts. The development has been worked at by Moseley (No. 18), Hutton (No. 19), Balfour (No. 28), and more in detail by Kennel (Nos. 32 and 33), Sheldon (No. 45), Sclater (No. 46), and myself (No. 39).

There can be no doubt that Peripatus is an Arthropod, for it possesses the following features, all characteristic of that group, and all of first-class morphological importance. (1) The presence of appendages modified as jaws. (2) The presence of paired lateral ostia perforating the wall of the heart and putting its cavity in communication with the pericardium. The importance of this feature as an Arthropod character was first pointed out by Lankester. (3) The presence of a vascular body cavity and pericardium (haemocœlic body cavity). (4) The inconspicuous character of the cœlom in the adult. Finally, the tracheæ, though not characteristic of all the classes of the Arthropoda, are found nowhere outside that group, and constitute a very important additional reason for uniting Peripatus with it.

Peripatus, though indubitably an Arthropod, differs in such important respects from all the old-established Arthropod classes, that a special class, equivalent in rank to the others, and called Prototraceata, has had to be created for its sole occupancy. This unlikeness to other Arthropoda is mainly due to the Annelidan affinities which it presents, but in part
to the presence of the following peculiar features: (1) the number and diffusion of the tracheal apertures, (2) the restriction of the jaws to a single pair, (3) the disposition of the generative organs, (4) the texture of the skin, and (5) the simplicity and similarity of all the segments of the body behind the head.

The Annelidan affinities are superficially indicated in so marked a manner by the thinness of the cuticle, the dermo-muscular body wall, the hollow appendages, that, as already stated, many of the earlier zoologists who examined Peripatus placed it amongst the segmented worms; and the discovery that there is some solid morphological basis for this determination constitutes one of the most interesting points of the recent work on the genus. The Annelidan features are: (1) the paired nephridia in every segment of the body behind the first two (Saenger, Balfour), (2) the presence of cilia in the generative tracts (Gaffron). It is true that neither of these features are absolutely distinctive of the Annelida, but when taken in conjunction with the Annelid disposition of the chief systems of organs, viz. the central nervous system, and the main vascular trunk or heart, may be considered as indicating affinities in that direction. Peripatus, therefore, is zoologically of extreme interest from the fact that, though in the main Arthropodan, it possesses features which are possessed by no other Arthropod, and which connect it to the group to which the Arthropoda are in the general plan of their organisation most closely related. It must, therefore, according to our present lights, be regarded as a very primitive form; and this view of it is borne out by its extreme isolation at the present day. Peripatus stands absolutely alone as a kind of half-way animal between the Arthropoda and Annelida. There is no gradation of structure within the genus; the species are very limited in number, and in all of them the peculiar features above mentioned are equally sharply marked.

We may, therefore, with some justice, regard Peripatus as an animal which has persisted for a long time, with but little structural modifications; as the representative of an ancient
group, once widely diffused,¹ and probably rich in species and genera, and closely related to the ancestors of living Arthropoda. It probably has owed its preservation, as so many of the survivals of ancient types seem to have done, to the peculiar habits of life which are shared by all the living members of the class, viz. the habitual avoidance of the light of day, and the habit of seeking the obscurity and protection afforded by the spaces beneath stones and beneath the bark of trees.

Peripatus, though a lowly organised animal, and of remarkable sluggishness, with but slight development of the higher organs of sense, with eyes the only function of which is to enable it to avoid the light—though related to those animals most repulsive to the aesthetic sense of man, animals which crawl upon their bellies and spit at, or poison, their prey—is yet, strange to say, an animal of striking beauty. The exquisite sensitiveness and constantly changing form of the antennæ, the well-rounded plump body, the eyes set like small diamonds on the side of the head, the delicate feet, and, above all, the rich colouring and velvety texture of the skin, all combine to give these animals an aspect of quite exceptional beauty. Of all the species which I have seen alive, the most beautiful are the dark green individuals of Capensis, and the species which I have called Balfouri. These animals, so far as skin is concerned, are not surpassed in the animal kingdom. The drawing on Pl. I. is from one of the dark green specimens of Capensis. Clever as the drawing is, the artist has failed to catch the exquisite velvet of the skin; but this could hardly be expected in a lithograph. I never shall forget my astonishment and delight when on bearing away the bark of a rotten tree-stump in the forest on Table Mountain, I first came upon one of these animals in its natural haunts, or when Mr. Trimen showed me in confinement at the South African Museum a fine fat, full-grown female, accompanied by her large family of thirty or more just-born but pretty young, some of which were

¹ That the class had once a world-wide diffusion is indicated by the wide and discontinuous distribution of the living species.
luxuriously creeping about on the beautiful skin of their mother's back.

THE SOUTH AFRICAN SPECIES OF PERIPATUS.

The following is a list of the distinct species of Peripatus which have so far been found in South Africa: Capensis (Table Mountain), Balfouri (Table Mountain), brevis (Table Mountain), Moseleyi (near Williamstown). In addition to these there are a certain number of other possible species, concerning the distinctness of which, however, I cannot be certain.

General Characters of the South African Peripatus.

Peripatus with three spinous pads on the legs, with two primary papillae on the anterior side of the foot (fig. 2), and a small tooth at the base of the main tooth on the outer blade of the jaw (fig. 28). The last fully developed leg of the males is provided with a white papilla on its ventral surface (fig. 4), and an enlarged crural gland. The generative opening is always subterminal and behind the last pair of fully developed legs. The ovaries are attached to the floor of the pericardium by a ligament which passes off from their front end. The terminal unpaired portion of the vas deferens of the male is short. The ova are large, but with little food-yolk. The portion of the proximal pad of the fourth and fifth legs, which carries the opening of the nephridium, is separated by faintly marked grooves from the rest of the pad (fig. 9). The legs appear, with rare doubtful exceptions, to be constant in number in all specimens of the same species. The median line of the dorsal surface is destitute of pigment.

*Peripatus capensis* being the best known and the most easily procured will be taken as the type of this group of species.
Peripatus capensis.

South African Peripatus with seventeen pairs of claw-bearing ambulatory legs.

The females are, on the whole, larger than the males, but the difference between them is not very marked. A large female would measure about 65 mm. (2½ inches), and a large male about 48 mm. There are, however, other external differences between the sexes. The last leg of the male is smaller than the preceding, and rarely touches the ground when the animal is walking, while in the female it is as large as the others, and used in walking. Further, the last leg of the male possesses, on its ventral surface, a small white papilla (fig. 4), at the apex of which opens its crural gland, which is much enlarged.

In the living animal (Pl. I) the skin has a beautiful velvety texture. This is especially noticeable in the darker specimens.

Colour.—The colour varies in different individuals. But in general it may be said that the ventral surface has a light colour, and that the dorsal is darkly pigmented. The principal colours are two in number, which present every variation in tint in different individuals and in different parts of the body of the same individual. They are (1) a dark green, graduating to a bluish grey; (2) a brown, varying to a red orange.

The ventral surface is almost entirely free from the green pigment, but possesses a certain amount of light brown. This brown pigment is more conspicuous and of a darker shade on the spinous pads of the legs. The only part of the ventral surface where the green pigment is always present is the ventral side of the foot, where it has a blue tint, and round the lips (fig. 5). In the latter situation there are a number of green papillæ, with which are intermingled a few of an orange colour. Very rarely there is a suspicion of green pigment along the middle line of the ventral surface, and in one specimen I found the distal pad of the leg to contain green pigment.
While the colour of the ventral surface is practically the same in all individuals, that of the dorsal differs in almost all. The differences are due to the varying proportions in which the green and brown pigments are present.

To facilitate matters I will describe two extreme cases: (1) a very dark green specimen (fig. 1), in which the brown is very inconspicuous, and (2) a red specimen, in which the brown predominates.

(1) The skin between the close-set papillae, so far as it can be observed, is a bluish grey; but on the papillae the pigment has a very dark green colour, except on a few, in which it is brown (even these may be absent). The ground colour, i.e. the colour of the skin between the papillae, varies in shade in different places. On the dorsal sides of the legs and along a dorso-lateral band at the bases of the legs, extending the whole length of the body, it is lighter than elsewhere, while on each side of the median dorsal white line it is much darker than elsewhere. These differences may be partly due to the closer aggregation of the papillae in one place than in the other.

(2) The pigment of the skin and of most of the papillæ is a reddish brown, except on each side of the dorsal white line and on the dorsal sides of the legs where it is green. Scattered amongst the brown papillæ are a considerable number of green. The brown colour is of a lighter shade along a dorso-lateral band, extending the whole length of the body at the base of the legs, and from this band green papillæ are almost entirely absent. The brown pigment is, however, almost entirely absent from the dorsal side of the legs on each side of the dorsal white line.

The conditions intermediate between these two extreme cases are due to the variations in the number of the brown papillæ. As a peculiarity of these intermediate cases may be mentioned the fact that the brown pigment extends into the skin round the base of the brown papillæ, giving the brown papillæ a brown setting, so that when a number of them occur together the skin between the papillæ has an entirely brown colour (as in the brown specimens). Brown papillæ are most numerous in the light band at the bases of the legs, and are
sometimes so numerous that the ground colour in that region is brown, though green elsewhere on the back.

The pigment is always present, whether on the papillae or between in minute square, pentagonal, and hexagonal patches. The darkness of the skin is probably mainly due to the number of these patches present in any given area.

The antennae are always green, the brown being almost entirely absent from them, and they are the first to acquire the green colour in the embryo. In fact the young at birth are almost quite white excepting the antennae.

The colour seems hardly at all affected by the action of spirit. The flesh-coloured brown of the ventral surface is sometimes slightly reddened when the animal is first put into spirit, but the red tinge soon vanishes, being apparently dissolved out by the spirit, which in such cases becomes slightly coloured.

**Ridges and Papillae of the Skin.**—The skin is thrown into a number of transverse ridges, along which the primary wart-like papillae are placed.

The papillae, which are found everywhere, are especially developed on the dorsal surface, less so on the ventral. The papillae round the lips differ from the remaining papillae of the ventral surface in containing a green pigment. Each papilla bears at its extremity a well-marked spine.

The ridges of the skin are not continued across the dorsal middle line, being interrupted by the whitish line already mentioned. Those which lie in the same transverse line as the legs are not continued on to the latter, but stop at the junction of the latter with the body. All the others pass round to the ventral surface and are continued across the middle line; they do not, however, become continuous with the ridges of the other side, but passing between them gradually thin off and vanish. The ridges on the legs are directed transversely to the long axes of the legs, i.e. are at right angles to the ridges of the rest of the body.

The papillae of the dorsal surface are not arranged in a single row in the ridges, but in more than one row, in fact a ridge varies in thickness in different parts of its course.
Further, the dorsal ridges are interrupted by thin and sharp, less coloured lines, which are somewhat diagonally arranged, and divide the ridges into lozenge-shaped areas (vide figs. 1 and 10).

The antennæ are ringed and taper slightly till near their termination, where they present a slight enlargement.

The rings consist essentially of a number of coalesced primary papillæ, and are, therefore, beset by a number of spines like those of the primary papillæ. They are more deeply pigmented than the rest of the antenna.

The free end of the antenna is covered by a cap of tissue like that of the rings. It is followed by four or more rings placed close together on the terminal enlargement. There appears to be about thirty rings on the antennæ of all adults of this species. But they are difficult to count, and a number of small rings occur, between them, which are not included in the thirty.

The antennæ are prolongations of the dorso-lateral parts of the anterior end of the body.

The eyes are paired and are situated at the roots of the antennæ on the dorso-lateral parts of the head. Each is placed on the side of a protuberance which is continued as the antenna, and each presents the appearance of a small crystalline ball inserted on the skin in this region.

The rings of papillæ on that part of the head from which the antennæ arise lose their transverse arrangement. They are arranged nearly concentrically to the antennal rings, and have a straight course forwards between the antennæ.

The oral papillæ are placed at the sides of the head. They are attached ventro-laterally on each side of the lips. The duct of the slime gland opens through their free end. They possess two main rings of projecting tissue, which are especially pigmented on the dorsal side; and their extremities are covered by papillæ irregularly arranged (vide description of oral papilla of New Zealand species, p. 29).

The Buccal Cavity.—The buccal cavity has the form of a fairly deep pit, of a longitudinal oval form, placed on the ventral surface of the head, and surrounded by a tumid lip.

The lip is covered by a soft skin, in which are numerous
organs of touch, similar to those in other parts of the skin, having their projecting portions enclosed in delicate spines formed by the cuticle. The skin of the lips is raised into a series of papilliform ridges, whose general form is shown in fig. 5; of these there is one unpaired and median behind, and a pair, differing somewhat in character from the remainder, in front, and there are, in addition, seven on each side. The cutaneous papillae round the front of the lips are raised up and appear like a second outer lip concentric with the anterior part of the real lip, with the posterior part of which it is continuous.

The structures within the buccal cavity are shown as they appear in the surface views in fig. 5. In the median line of the buccal cavity in front is placed a thick muscular protuberance, which may perhaps conveniently be called the tongue, though attached to the dorsal instead of the ventral wall of the mouth. It has the form of an elongated ridge, which ends rather abruptly behind, becoming continuous with the dorsal wall of the pharynx. Its projecting edge is armed by a series of small teeth, which are thickenings of the chitinous covering prolonged from the surface of the body over the buccal cavity. Where the ridge becomes flatter behind, the row of teeth divides into two, with a shallow groove between them.

The Jaws.—On each side of the tongue are placed the jaws, which are a pair of appendages, modified in the characteristic arthropodan manner, to subserve mastication. They are essentially short papillae, moved by an elaborate and powerful system of muscles, and armed at their free extremities by a pair of cutting blades or claws. The latter structures are, in all essential points, similar to the claws borne by the feet, and, like these, are formed as thickenings of the cuticle. They have, therefore, essentially the characters of the claws and jaws of the Arthropoda, and are wholly dissimilar to the setæ of Chætopoda. They are sickle-shaped, and, as shown in fig. 5, have their convex edge directed nearly straight forwards, and their concave or cutting edge pointed backwards. The inner cutting plate has five to eight teeth (fig. 27). The outer plate
has one main tooth (fig. 28), at the base of which is a small
tooth. This accessory tooth is found on the outer blade in
all South African species. Posteriorly, the behaviour of the
two blades is very different. The epithelial ridge bearing the
outer blade is continued back for a short distance behind the
blade, but the cuticle covering it becomes very thin, and it
forms a simple epithelial ridge placed parallel to the inner
blade. The cuticle covering the epithelial ridge of the inner
blade is, on the contrary, prolonged behind the blade itself as
a thick rod, which, penetrating backwards along a deep pocket
of the buccal epithelium, behind the main part of the buccal
cavity for the whole length of the pharynx, forms a very
powerful lever, on which a great part of the muscles connected
with the jaws find their insertion.

The Ambulatory Appendages.—The claw-bearing legs
are seventeen in number, and with the exception of the fourth
and fifth pairs in both sexes, and the last in the male, they all
resemble each other fairly closely. A typical appendage will
be first described and the small variations found in the appen-
dages just mentioned will then be pointed out. Each consists
of two main divisions, a large proximal portion the leg, and
a narrow dorsal, claw-bearing portion, the foot.

The leg has the form of a truncated cone, the broad end of
which is attached to the ventro-lateral body wall, of which it
appears to be, and is, a prolongation. It is marked by a number
of rings of primary papillæ, placed transversely to the long
axis of the leg, the dorsal of which contain a green and the
ventral a brown pigment. These rings of papillæ at the
attachment of the leg, gradually change their direction and
merge into the body rings. At the narrow end of the cone
there are three ventrally placed pads, in which the brown
pigment is dark, and which are covered by a number of spines
precisely resembling the spines of the primary papillæ. These
spinous pads are continued dorsally, each into a ring of
papillæ.

The papillæ of the ventral row next the proximal of these
spinous pads are intermediate in character between the primary
papillæ and the spinous pads. Each of these papillæ is larger than a normal papilla, and bears several spines (fig. 2). This character of the papillæ of this row is even more marked in some of the anterior legs than in the one figured; it seems probable that the pads have been formed by the coalescence of several rows of papillæ on the ventral surface of the legs. On the outer and inner sides of these pads the spines are absent, and secondary papillæ only are present.

In the centre of the basal part of the ventral surface of the foot there is present a group of larger papillæ, which are of a slightly paler colour than the others. They are arranged so as to form a groove, directed transversely to the long axis of the body, and separated at its internal extremity by a median papilla from a deep pit which is placed at the point of junction of the body and leg. The whole structure has the appearance, when viewed with the naked eye, of a transverse slit placed at the base of the leg. The segmental organs open by the deep pit placed at the internal end of this structure. The exact arrangement of the papillæ round the outer part of the slit does not appear to be constant.

The foot is attached to the distal end of the leg. It is slightly narrower at its attached extremity than at its free end, which bears the two claws. The integument of the foot is covered with secondary papillæ, but spines and primary papillæ are absent, except at the points now to be described.

On each side of the middle ventral line of the proximal end of the foot is placed an elliptical elevation of the integument covered with spines. Attached to the proximal and outer end of this is a primary papilla. At the distal end of the ventral side of the foot on each side of the middle line is a group of inconspicuous pale elevations, bearing spines.

On the front side of the distal end of the foot, close to the socket in which the claws are placed, are two primary papillæ, one dorsal and the other ventral.

On the posterior side of the foot the dorsal of these only is present. The claws are sickle-shaped, and placed on papillæ on the terminal portion of the foot. The part of the
foot on which they are placed is especially retractile, and is generally found more or less telescoped into the proximal part (as in the figure).

The fourth and fifth pairs of legs exactly resemble the others, except in the fact that the proximal pad is broken up into three, a small central and two larger lateral. The enlarged segmental organs of these legs open on the small central division.

The last (17th) leg of the male (fig. 4) is characterised by possessing a well-marked white papilla on the ventral surface. This papilla, which presents a slit-like opening at its apex, is placed on the second row of papillae, counting from the innermost pad, and slightly posterior to the axial line of the leg.

The anal papillæ, or as they should be called, generative papillæ, are placed one on each side of the generative aperture.

The generative aperture is subterminal and on the ventral surface. It is inconspicuous in most specimens.

Internal Anatomy.—The points of internal anatomy which require to be noted in an account of the species relate entirely to the generative organs. In the male the ductus ejaculatorius (posterior unpaired part of vas deferens, penis of Moseley) is short, and the crural glands of the seventeenth pair of legs are much elongated, reaching forward for a considerable distance in the lateral compartment of the body cavity.

In the female the ovaries are closely approximated and short. They are united to the floor of the pericardium by a single ligament passing off from their front end. Receptacula seminis are absent. The ova contain but little food-yolk. They are oval in shape, and the greatest length of an unsegmented ovum which has passed into the oviduct is 56 to 6 mm.

Habits.—They live beneath the bark and in the crevices of rotten stumps of trees, and beneath stones. So far they have only been found, so far as I can ascertain, in the woods on the slope of Table Mountain. They require a moist atmo-
sphere, and are exceedingly susceptible to drought. They avoid light, and are therefore rarely seen, and it is owing to this fact that, though fairly numerous, they were for so long unknown to the inhabitants of the Cape Peninsula. They move with great deliberation, picking their course by means of their antennae and eyes. It is by the former that they acquire a knowledge of the ground over which they are travelling, and by the latter that they avoid the light. The antennae are extraordinarily sensitive, and so delicate indeed, that they seem to be able to perceive the nature of objects without actual contact. When irritated they eject with considerable force the contents of their slime reservoirs. The force is supplied by the sudden contraction of the muscular body wall. They can squirt the slime to the distance of almost a foot. The slime, which appears to be perfectly harmless, is extremely sticky, but it easily comes away from the skin of the animal itself.

I have never seen them use their apparatus for the capture of prey. So far as I can judge it is used as a defensive weapon; but this of course will not exclude its offensive use. They will turn their heads to any part of the body which is being irritated and violently discharge their slime at the offending object. Locomotion is effected entirely by means of the legs, with the body fully extended.

Of their food in the natural state we know nothing; but it is probably mainly, if not entirely, animal. Those which I kept in cavity eagerly devoured the entrails of their fellows, and the developing young from the uterus. They also like raw sheep’s liver. They move their mouths in a suctorial manner, tearing the food with their jaws. They have the power of extruding their jaws from the mouth, and of working them alternately backwards or forwards. This is readily observed in individuals immersed in water.

The young are born in April and May. They are almost colourless at birth, excepting the antennae, which are green, and their length is 10 to 15 mm. A large female will produce thirty to forty young in one year. The period of gestation is
thirteen months, that is to say, the ova pass into the oviducts about one month before the young of the preceding year are born. They are born one by one, and it takes some time for a female to get rid of her whole stock of embryos; in fact, the embryos in any given female differ slightly in age, those next the oviduct being a little older (a few hours) than those next the vagina.

The mother does not appear to pay any special attention to her young, which wander away and get their own food.

There does not appear to be any true copulation. The male deposits small, white, oval spermatophores, which consist of small bundles of spermatozoa cemented together by some glutinous substance, indiscriminately on any part of the body of the female. Such spermatophores are found on the bodies of both males and females from July to January, but they appear to be most numerous in our autumn.

The testes are active from June to the following March. From March to June the vesiculae of the male are empty.

**Peripatus Balfouri** (n. sp.).

*South African Peripatus, with eighteen pairs of claw-bearing ambulatory legs, of which the last pair is rudimentary, with white papillae on the dorsal surface.*

*Peripatus Balfouri* resembles very closely *P. capensis*. The points of difference are as follows:

The dorsal skin has an olive-green tinge. The largest papillae are white, except at their free extremities, which are green (fig. 10). The white spreads out a little round the base of the papillae. Brown tints are entirely absent in all the specimens which I have examined except one.

The ventral surface is whiter than in *Capensis*, but the papillae are faintly green. The same remark applies to the ventral surface of the legs.

**The Ambulatory Appendages.**—The claw-bearing legs are eighteen pairs. The legs of the eighteenth pair are smaller

1 Peters (No. 25) states that there are in the Berlin Museum specimens from the Cape with eighteen pairs of legs (see p. 25).
than the rest (fig. 24). The remaining ambulatory appendages resemble, except in the following points, those of Capensis. The three spinous pads are green, and the middle one is broader than the other two; the ventral surface of the proximal part of the leg is white, and the papillae are a bluish green; the groove at the base is less marked than in Capensis.

The foot is rather more delicate than in Capensis, and the spines on the ventral side of the base of the claws are placed on two pairs of small papillae (fig. 9).

The male is distinguished from the female, as in Capensis, by the possession of a white papilla on the ventral side of the legs of the seventeenth pair, in the same position as in Capensis, and the legs of the eighteenth pair are smaller than in the female. So small are they, indeed, that they are hardly distinguishable from the large papillae found near the hind end of the body; but they bear two claws, and a rudiment of the foot may be made out.

In the female the legs of the eighteenth pair (fig. 24) present the following features:—The foot seems to be normal and unreduced, but the leg is much reduced, presenting on the ventral side only three rows of papillae and one spinous pad, which indeed shows, in some specimens more than others, its constitution of separate papillae. The pad and papillae are all tinged with green.

The embryos are much smaller than in Capensis. In preserved specimens the length of the fertilised ovum is 4 to 4.8 mm.; and a full sized adult specimen may reach the length of 43 mm. The generative orifice is between the rudimentary legs of the eighteenth pair. As a peculiarity in habits may be mentioned the fact that the individuals of this species nearly always coil themselves into a spiral when touched, while Capensis simply contracts and shortens itself.

Locality—Table Mountain.
Other South African species.

In addition to these two South African species from Table Mountain, the following varieties, some of which at least are probably distinct species, are known.

1. One with fourteen pairs of legs, already named *P. brevis* (Blainville). This species was found by M. Goudot beneath a stone in the woods on Table Mountain. It has been shortly described by Blainville in a note on p. 38 of Gervais’ “Études pour servir à l'histoire naturelle des Myriapodes” ('Ann. d. Sci. Nat.,' series ii, vol. vii) as follows:—“Corps subfusiform pourvu de quatorze paires de pattes, noir velouté en dessus, blanchâtre en dessous; longeur totale en comprenant les antennes, 43 mill.; plus grande largeur, 4 mill.”

2. Another with nineteen pairs of legs,¹ reported by Mr. Roland Trimen from Plettenberg Bay, Cape Colony, but hitherto undescribed.

3. A third, in my possession, from Table Mountain with twenty pairs of claw-bearing legs, I have found one specimen only. Peters (No. 25) records the existence of specimens from the Cape with twenty pairs of legs (see below p. 455).

4. A fourth, with twenty-one pairs of legs from near Williamstown, South Africa, I have only seen three specimens. They are in the possession of the Indian Museum.

5. A fifth, with twenty-two pairs of legs, of which two specimens are known to me. One of these is in the possession of the Indian Museum; the locality is marked “near Williamstown, S. Africa.” The other was found by Mr. J. P. Mansel Weale, and given by him to Mr. Wood Mason, who in his turn gave it to Professor Balfour. This specimen, of which I have not been able to ascertain the exact locality, is in my possession, and is figured on Pl. XXXVII fig. 8.

¹ There are specimens in the Berlin Museum with nineteen pairs of legs (Peters, No. 25).

² Peters (No. 25) records the existence of specimens from the Cape with twenty-one and twenty-two pairs of legs (see below, p. 455).
Of these five varieties I have not seen the first two. I have, however, had full opportunity of examining preserved specimens of the last three and will now shortly describe my observations on them.

**Peripatus with twenty pairs of claw-bearing legs.**—
One specimen only—a female—is known to me. Locality, Table Mountain. Length of spirit specimen 23 mm.

The specimen very closely resembles *P. Balfouri*, and would be mistaken for the latter were not its legs counted. The skin presents an identical appearance. The last pair of legs are very small and rudimentary, and the generative opening, which is subterminal just in front of the anus, is between them.

The first nineteen pairs of legs are all normal and resemble exactly, so far as I can judge, those of *P. Balfouri*. In the legs of the twentieth pair, while the foot is normal the leg is much reduced in size. It is entirely without the spinous pads, and possesses only three rows of papillae of which the row next the foot is slightly tinged with green, the other two being white.

The only other difference which I was able to detect between this specimen and *P. Balfouri* consisted in the very small amount of green on the ventral surface, which is almost white.

On the whole I am not inclined to establish at present a distinct species for the reception of this specimen, but would prefer to regard it provisionally as a variety of *P. Balfouri*.

**Peripatus Moseleyi.**

*South African Peripatus, with twenty-one and twenty-two pairs of legs.*

All the specimens under this head presented the same general appearance (fig. 24). Were it not for the number of legs they would be taken for specimens of Capensis. The ventral surface is light brown and the dorsal an olive green, with scattered brown patches. Green is entirely absent from the ventral surface, excepting on the foot and distal pad, and sometimes a very little on the middle pad. On the dorsal surface there is a band on each side at the base of the legs, in
which the brown papillae are so numerous as to cause the appearance of a brown band. Elsewhere on the dorsal surface the brown papillae are very sparingly scattered.

They are all reported from a part of South Africa far removed from Table Mountain, the home of Balfouri and Capensis, viz. near Williamstown (with the possible exception of the one figured, the locality of which I do not know). Unfortunately I have only been able to see preserved specimens, which, on account of the great contraction they had undergone in dying, were not very favorable for observation.1

Specimens of Peripatus Moseleyi with twenty-one pairs of legs.—Skin as in Capensis. Foot and legs as in Capensis. At the bases of some of the legs (no constancy in the different specimens), immediately internal to the opening of the segmental organ, a small white patch of a tumid appearance is present. It occupies the same position as the large tumid papillae on the ventral side of the leg of Capensis (see Pl. XXXVI, fig. 2), and has been noticed by Wood Mason (No. 23). The generative opening is subterminal, and on each side of it there is an inconspicuous anal papilla. The dorsal side of the foot is marked with streaks of green pigment, arranged parallel to its long axis. The streaks are much less distinct on the anterior than on the posterior feet.

Two of the specimens were smaller than the third, from which they differed by possessing a distinct white papilla on the last (twenty-first) leg, exactly resembling in appearance and position the papilla on the last leg of Capensis. I opened one of these smaller specimens, and found it to be a male; while the larger specimen turned out to be a female.

The female was about 26 mm. in length, the male about 20 mm.

The specimens of P. Moseleyi with twenty-two pairs of legs were both females. They resemble the specimens with twenty-one legs, so far as I could see from a study of the contracted

1 Drowning (twenty-four hours or more) and then spirit is the best method of killing Peripatus for museum purposes and observation of external characters.
specimens at my disposal, except in two points: (1) in the absence of the aural papillae, and (2) in the fact that the streaks on the dorsal side of the feet were entirely absent in the first nine pairs of legs. The legs of the last pair resemble, in all respects, the preceding, and the genital opening is behind them.

One of these specimens measured 26 mm. and the other 30 mm. in length.

Inasmuch as I have not been able to find any marked characters associated with the character afforded by the number of legs, and further, as I have had no opportunity of ascertaining whether the latter character is transmitted in reproduction, I am inclined not to establish two distinct species but to regard the specimens with twenty-two legs to be a variety of the species Peripatus Moseleyi, which is distinguished by the possession of twenty-one legs, and a subterminal genital opening behind the last legs.

Peters (No. 25) in a short paper on the variation of the number of legs in P. capensis, states that the following specimens were brought to him from Cape Town by a friend of his: three specimens with 22 legs, eight with 21, eight with 20, one with 19, one with 18, and two with 17 legs. He adds that they were all found in the same locality, which, however, is not mentioned. He gives no description of the specimens, beyond mentioning the number of legs, and it is not therefore possible to say whether he is right or not in his view that they all belong to the species Capensis. I may add that, though I have examined more than a thousand specimens from the Cape Peninsula, I have only seen one specimen with more than eighteen pairs of legs.
THE AUSTRALASIAN SPECIES.

General Characters.

Peripatus with fifteen pairs of claw-bearing ambulatory legs, with three spinous pads on the legs, and a primary papilla projecting from the median dorsal portion of the foot (figs. 21, 21a). The ventral organs are conspicuous, and the males are considerably smaller than the females. The generative opening is between the legs of the last pair, and there are no anal papillae. The number of legs are constant in all specimens. The ovaries are attached by their whole length to the floor of the pericardium, and each oviduct is provided with a receptaculum seminis. The unpaired portion of the vas deferens is long and complicated in structure. The ova are large and heavily charged with food yolk. The portion of the proximal pad of the fourth and fifth legs which carries the opening of the nephridium is continuous distally with the rest of the pad (fig. 21). A median dorsal white line is present.

Two species are known from the Australasian region; *P. nova-zealandiae* from New Zealand, and *P. Leuckarti* from Queensland in Australia.

The former was first described by Captain Hutton (No. 19), the latter by Saenger (No. 15).

**Peripatus Novae-Zealandiae.**

*(Figs. 7 and 17.)*

_Australasian Peripatus, without a small tooth at the base of the main tooth of the outer blade of the jaw, and without a white papilla on the ventral side of the last leg of the male._

The males are considerably smaller and less numerous than the females. The length of a large female is 50 mm. (2 inches), that of a large male 25 to 30 mm. in the extended condition after drowning. There is no external difference which enables us to distinguish the sexes. The ventral organs, owing to the
character of their pigment, are much more conspicuous than in the South African species.

**Colour.**—The colour varies in different individuals (c.f. figs. 7 and 17). The ground colour varies exceedingly in tint; it consists of a bluish grey, or slate colour, or violet; it is darker on the antennæ than elsewhere, and is especially concentrated in small, dark, square, pentagonal, and hexagonal patches lying close together over the whole surface of the body. Sometimes the outline of these patches is darker than the centre.

The pigment of the papillæ is also much darkened, but this requires a separate description as the variations in the colour of different individuals is mainly due to the papillæ. In all specimens a certain number of the papillæ have brown or orange pigment, which spreads out for a short distance around the base of the papilla, as in the case of the white papillæ of the South African *Peripatus Balfouri*, so that if many of these papillæ occur close together the ground colour is brown or orange and the slate entirely displaced; if such are numerous, they impart a distinctly brown aspect to the specimen. They are scattered irregularly over the whole surface of the body, but are most numerous, as in *Capensis*, in two bands on the sides of the dorsal surface at the base of the legs, where, indeed, in some specimens they almost completely replace the blue.

In most specimens, however, the greater number of papillæ presents a pigment which resembles more or less closely that of the ground colour. In many specimens—perhaps the majority—the papillæ have a dark slate colour; but in some specimens they may have a distinctly blue pigment, and occasionally even a dark purple. The lips, as in *Capensis*, are always destitute of pigment, and, as in that species, there is a sharp line extending along the middle of the whole length of the dorsal surface, in which the pigment is either absent or of an extremely light shade. On each side of this line the pigment in the papillæ is much darkened. The pads of the legs vary much in colour. In most specimens the distal one is blue, the middle one brown or orange, and the proximal one brown or orange in the centre,
and blue along the outer and inner border. In some specimens, however, they are all blue, and in others all brown or orange. In short, it may be said that the colour of the pad varies from blue with hardly any admixture of brown, to brown or orange without any blue. The distal pad is always the most blue. The row of composite large papillae next to the proximal pad presents the predominant colour of the proximal pad. The blue colour is always absent from the ventral organs, which are either white, brown, or orange.

In all specimens there is a band of especially dark papillae extending from the ventral extremity of the leg towards the ventral organ (fig. 19). The opening of the segmental organ is placed in the outer end of this band. The ventral surface is almost always mottled, the blue and yellow pigment being distributed in patches; the colour in each kind of patch extending between the papillae as well as on to them.

The ridges and papillae of the skin are arranged as in the South African species.

The antennae resemble those of the South African species. They are ringed and slightly swollen near the free end (fig. 16). In none of the specimens that I examined did they present any brown pigment. They are entirely of the blue (violet?) grey colour, which forms the ground colour of the skin. The rings are beset with spines, and are covered by closely approximated patches of dark pigment such as have been already described. On the anterior edge of the rings at the front end of the antennae there is a row of hexagonal, lighter-coloured spaces. At the bases of the spines also the pigment is lighter than elsewhere on the rings. Between the rings spines and patches are absent, and the pigment is of a lighter colour. The free end of the antenna is rounded and covered by a cap of integument resembling that on the rings and bearing a large number of spines, as in all the species of Peripatus that I have seen.

The eyes resemble in position and character (fig. 18) those of the South African species.

The oral papillae resemble essentially those of Capensis.
Fig. 20 shows very clearly the peculiar collapsable joints which this appendage possesses in all the species.

The buccal cavity, tongue, and lips resemble in all respects the same structures in the South African species.

The jaws differ from those of the latter only in being without the small tooth on the outer blade.

The ambulatory appendages (fig. 21) are fifteen in number in all the specimens which I have examined. They resemble in their general features the same structures in Capensis, so that in the following short description stress will be laid only on the points in which they differ from the latter.

The opening of the segmental organ at the base of the leg is much more indistinct than in Capensis, and the peculiar tumid papillae, which in Capensis extends from its outer border on to the ventral surface of the leg, are absent in this species. There are three pads, but the large papillae of the row adjoining the proximal pad are larger with regard to the ordinary papillae than in Capensis. Sometimes, indeed, they are so large as to present the appearance, unless closely examined, of one continuous spinous pad.

The foot differs from that of Capensis in the following points. The two prominent papillae, placed one on each side (anterior and posterior) of the base of the foot are absent. The dorsal side of the foot near the free extremity possesses a papilla (fig. 21a), while the anterior face bears, like the posterior, only one papilla. As in Capensis, the opening of the nephridia of the fourth and fifth legs are placed on a small portion of the proximal pad. The part of the pad around the opening is only partly separated from the rest (vide fig. 21). The fifteenth leg, so far as I could ascertain, differs only in size (being slightly smaller) from the preceding, and is without the white papilla found on the last leg of the male of the South African species. Anal papillae are never present.

Internal Anatomy.—As already explained, I do not propose to give in the monograph any detailed account of
internal structure. It will be sufficient for my purpose to sum up briefly the more striking differences between the various species.

The internal structure of *Peripatus novae-zealandiae* closely resembles that of the South African species. The differences, so far as I have been able to observe them, chiefly concern the generative organs, and the crural glands. It has recently been shown by Miss Sheldon (No. 40) that the crural glands are entirely absent from this species in both sexes.

The generative organs of the male differ from those of the Cape species in three points, viz.: (1) In the much greater length of the terminal unpaired portion of the vas deferens; (2) in the absence of any specially enlarged crural glands in the last pair of legs; (3) in the fact (recently shown by Miss Sheldon, No. 40), that the accessory glands, which are longer than in the male of *Capensis*, do not open with the vas deferens, but on the sides of the body outside the nerve-cord and close to the hind end. The terminal unpaired portion of the vas deferens is continuous with the two vasa deferentia (one of which passes as in *Capensis* beneath the two nerve-cords) at the level of the last pair of legs. Thence it is continued forwards for a considerable distance (as far as the level of the eighth legs in some cases); eventually bending round to pass backwards to its opening between the last pair of legs. Its walls increase in thickness from before backwards, and are of a distinctly gelatinous consistency in the greater part of their course.

The generative organs of the female differ from those of *Capensis* in two main points, viz.: (1) The two ovarian tubes are much longer, extending from the level of the eleventh to that of the thirteenth, and sometimes to that of the fourteenth leg, and are entirely separate from one another, each being suspended throughout its entire course to the pericardial floor by a distinct membrane. (2) There are two spherical receptacula seminis, each of which opens into the oviduct by two ducts; and the oviduct in the neighbourhood of these openings is slightly sacculated.

It will be remembered that in the Cape species the ovarian
tubes were closely applied together and united to the pericardial floor only at their anterior extremities by a single band.

Spermatozoa have been found in the receptaculum and in the oviduct near the opening of the latter. There are few, if any, spermatozoa in the ovary. I have not been able to see, though I have examined live specimens with great care, a trace of cilia in any part of the female organs. It will be seen from the above that I take exception to Captain Hutton’s description of the ovary as an ovate organ.

The ova are large, oval in shape, and heavily charged with food-yolk. They are surrounded by a membrane of the same nature as the egg membrane of P. capensis, but much tougher. The greatest length of an unsegmented ovum from the uterus is about 1.5 mm., the breadth 0.8 mm. The greatest number of embryos found in one animal was eighteen, twelve in one uterus and six in the other. But the number varies in the different specimens. Captain Hutton found eighteen in one uterus and eight in the other. The same naturalist states that “when the embryos are numerous there is a considerable difference in the point of development to which they have attained.” I can confirm this statement; but the greater number of the embryos in any given animal are of the same age.

Habits.—Captain Hutton (No. 19) has fully described the habits of this species. He says:

“They live in decayed wood, under stones, or in crevices of rock. They are nocturnal, but will feed in the daytime when hungry. They feed upon animals. I have seen one shoot out its viscid fluid from the oral papillae at a fly introduced into the jar in which it was confined, and stick it down; it then went up and sucked its juices, rejecting the whole of the integument. This viscid fluid is for offensive and not defensive purposes. In the winter they become half torpid, though procreation still goes on. During this time of the year I have never seen them feed, and they cannot emit their viscid

1 I have not been able to see any trace of the lateral vessel of Captain Hutton.
fluid, or only in very small quantity. They move with de-
liberation, entirely by means of their legs, the body being
much lengthened. When walking, the antennæ are constantly
moved about as feelers. If a needle is placed upright imme-
diately in front of one, the antenna is drawn past it without
actual contact; but the points of the hair probably touch the
needle. Although viviparous, the eggs are often extruded
before the development is complete, but these always die.”

From the study of the living specimens brought by Mr.
Evans I have been able to confirm Captain Hutton’s observa-
tion as to the habits of the species, so far as it was possible to
do so on imported specimens.

I have not been so fortunate as to see them catching flies
with their slime, but this is not to be wondered at considering
the greatly changed conditions in which I observed them. In
fact I have failed to keep the specimens alive for any length
of time in this country.

Having received two lots, one in July and the other in
December, I am able to make some conjectures as to the period
of gestation. Captain Hutton asserts that they breed all the
year round. The only other statement concerning the breeding
is, so far as I know, by Moseley (No. 20). He states that the
young are born in July. This is undoubtedly correct, for the
live specimens received by me at the end of July gave birth to
fully-developed young on the voyage, and directly after reach-
ing England, and those examined contained, in the great
majority of cases, either old embryos or none at all.

On the other hand, the specimens which came in December
contained, in the great majority of cases, unsegmented and
segmenting ova. But in a few (small specimens) the uterus
was empty, and again, in a still smaller number, there were
old embryos, and in some a few old embryos coexisted with the
more numerous young ova. These observations seem to me to
show that the eggs pass into the uterus in November and De-

 Pemberton.
ment¹ (No. 19), that he has "never opened one which did not contain embryos;" and that he found the uterus full of embryos in September and November. It must be admitted, therefore, that the point cannot be settled on the evidence before us. It is much to be regretted that none of the New Zealand naturalists have taken the trouble to determine a point so easy of observation.

With regard to the sexual relations, I am inclined to think that copulation does not take place, and that the end of the vas deferens, which I have called the ductus ejaculatorius, is not protrusible. I have, indeed, observed in spirit specimens small white ovoid bodies, which closely resemble the spermatozoa of the South African species, and I think there can be no doubt that the sexual relations are the same as in those species. The period of the year at which fertilisation is effected is unknown. Hutton has observed that the receptacula contain spermatozoa in November, but are empty in September. This observation distinctly confirms my deduction that the ova pass into the oviduct in November or December.

Before leaving this subject I may mention that I can entirely confirm Hutton's statement that the eggs are often extruded before the development is completed. This may possibly be a reminiscence of the time, probably not very remote, when the eggs were laid in the normal Arthropodan manner—a view which receives support from the thick shell, large size, and heavily yolked nature of the ovum of this species.

**Peripatus Leuckarti.**

Locality, Queensland.

*Australasian Peripatus, with fifteen pairs of legs, an accessory tooth on the outer blade of the jaw, and a white papilla on the ventral side of the last leg of the male.*

The following observations were made on two specimens most kindly placed at my disposal by Professor Jeffrey Bell, to whom they were sent by Dr. Ramsay, of Sydney. They were found

¹ It should be noted that Hutton does not state whether his observations were spread over the whole year.

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(vide No. 44) near Wide Bay in Queensland. The finder's name has not been communicated to me.

Both the specimens were much contracted and the feet bent ventrally on the legs, so that it was difficult to get a good view of the ventral surfaces of the feet.

The length of large specimen . . . . 16—17 mm.

" " small " . . . . 9—10 mm.

The large specimen was a female, and the small a male.

Generally it may be said of these specimens that they resemble almost exactly the New Zealand species. After careful search I have only been able to find three minute points of real difference between them. These are:

1. The outer blades of the jaws have an accessory tooth at the base of the main tooth, as in the Cape species.

2. The male has a rounded white papilla on the ventral face of the fifteenth leg, on each side of the genital opening. It is in the same position with regard to the leg as the corresponding structure in the Cape males.

3. The pigment on the ventral surface is much less conspicuous in this than in the New Zealand species, so that the mottled appearance presented by the ventral surface of the latter species is not found in these specimens. The pigment on the ventral surface of these specimens is much more marked in the lower parts of the papillae than elsewhere. In the skin between the papillae and at the apices of the papillae the pigment is so faint as to be hardly discernable. The result is that to the naked eye the ventral surface appears quite pale with coloured papillae projecting from it. The predominant pigment of the ventral surface is the blue, but orange is present. The hind end of the ventral surface in the region of the last three legs is darker than elsewhere, in consequence of the great number of the pigmented papillae.

In addition to the above characters, it may be mentioned that the genital papilla of the female is remarkably prominent, and bears at its free end a longitudinally disposed slit. In the male the genital papilla is fairly prominent, but its aperture is
wider and more rounded, resembling the same structure in both sexes of the New Zealand species. I append a short general description of the two specimens.

There are fifteen pairs of legs. The ventral surface is pale, dotted uniformly with pigmented papillae, which are more numerous behind. The dorsal surface is dark, and has a median white line. The pigment is of the two colours found in the New Zealand species, viz. bluish to green, and orange to brown. The blue pigment is much the most conspicuous on the dorsal surface. The antennae are blue mainly, but possess some orange pigment arranged in rings round their basal halves.

The genital papilla, which is remarkably prominent in the female, is between the legs of the fifteenth pair. The feet and legs resemble exactly, so far as could be made out, those of the New Zealand species. The feet have the median dorsal papilla so characteristic of that species; there are three pads on the legs, and a patch of blue pigment round the opening of the nephridia.

If there is any difference, it relates to a faint double row of somewhat turgid papillae proceeding outwards from the opening of the nephridium along the ventral surface of the leg. The same feature is present in a much more marked form in P. capensis. The opening of the nephridium is perhaps slightly more conspicuous than in the New Zealand species. The last leg of the male presents a white papilla on its ventral surface. The outer blade of the jaw has an accessory tooth.

The internal anatomy resembles, so far as I could make out, that of the New Zealand species.

In the female the ovaries were attached along their whole length, and possessed numerous oval white eggs of an average length of 27 mm. In addition there were some larger eggs of a yellowish colour, some of which were attached to the ovary, and some broken away and lying in the body cavity. The largest of these measured 75 mm. in length. They were full of yolk and without any visible membrane.

Each oviduct possessed the receptaculum seminis in a
position similar to that of the same structure in *Peripatus
novae-zealandiae*. The uterus was empty.

In the male the genital organs were normal, and the
unpaired portion of the vas deferens was long, and apparently
of a similar structure to that of the New Zealand species.

The specimens were not sufficiently well preserved for an
examination for the accessory glands.

**PERIPATUS FROM THE NEOTROPICAL REGION.**

*Peripatus* is found all over the northern part of the Neo-
tropical region. It is reported from Chili, Columbia, Cayenne,
Venezuela, Nicaragua, and from many of the West Indian
Islands, viz. Jamaica, Cuba, Trinidad, St. Thomas. I unfor-
tunately have only been able to make a complete study of the
species from Venezuela and of that from Demerara; of some
of the remainder I have only seen single specimens, or specimens
the preservation of which was not sufficiently good to allow of
the determination of specific characters. A partial exception
must be made in favour of the small species from Trinidad, of
which Dr. J. v. Kennel has been good enough to send me two
specimens; but these were, unfortunately, somewhat contracted
and not sufficient in number to enable me to generalise as to
specific characters. I trust, however, that the careful description
of the Venezuela species, the specimens of which were collected
by Professor Ernst at Caracas, and given to Professor Balfour,
will form a groundwork on which future collectors of *Peripatus*
from this region will be able to work.

Although I have failed in determining the relations between
the various specimens of *Peripatus* which have been found in
the Neotropical region, still I have seen enough to be able to
establish a certain number of characters which distinguish a
great number—and probably all—of the neotropical *Peripatus*
from those found in other regions. Those characters are stated
in the following definition:
General Characters of the Neotropical Species.

With four spinous pads on the legs, and two papillae on the anterior side of the foot. With generative aperture between the legs of the penultimate pair. Dorsal white line absent, and papillae arranged in a single row on the ridges of the skin. Many of the primary papillae have a terminal portion slightly constricted off from the main portion. Outer blade of jaw with one minor tooth, inner blade with one minor tooth next the main tooth (fig. 25), and a row of smaller minor teeth separated from the latter by a diastema. Unpaired part of vas deferens of great length. Ovary with oviducts entering its anterior end, and attached to pericardial floor by a single band of great length from the opposite end. Each oviduct provided with a receptaculum seminis with double duct, and with a thin-walled receptaculum ovorum. Ova minute without yolk. Embryos of very different ages in same uterus, and births probably taking place all the year round. Males generally smaller than females, and frequently with a smaller number of legs. The number of legs often inconstant in the same species in the same sex; in fact it may be said that the number of legs varies in all the Neotropical species which are at all well known. The opening of the nephridium of the fourth and fifth legs is on a papilla which is quite separate from the third pad (fig. 11).

Peripatus Edwardsii.

Neotropical Peripatus from Caracas with a variable number of legs—the smallest number being twenty-nine and the greatest thirty-four. Males with twenty-nine and thirty legs, and tubercles on a varying number of the posterior legs. The basal part of primary papillae are cylindrical.

I propose to reserve the name Edwardsii for the Neotropical species, which is best known, viz. that from Caracas. This has been described by Ernst and Gaffron. Whether the specimens obtained by Audouin and Milne-Edwards from Cayenne and named Edwardsii by Blanchard (No. 8) belong to
this species cannot be definitely settled until more specimens come to hand.

In *P. Edwardsii* the females are larger than the males and have a greater number of legs. This fact was first noticed by Gaffron. He found that the males possessed either twenty-nine or thirty legs, while of his females one had thirty-four, four had thirty-two, and four thirty-one. In my specimens, which came, I believe, from the same place as the specimens which Gaffron used for his first paper (No. 35), all the males had thirty or twenty-nine legs (four with thirty and three with twenty-nine), while of the females three had thirty-one, four had thirty-two, and one twenty-three (fig. 6). Ernst states that the full-grown animal has thirty-one pairs of legs, the new-born young but twenty-nine; and he deduces from this that the young are born with an incomplete complement of legs, and that new legs make their appearance in the subsequent growth of the animal. This, if true, would be important, as in no species of *Peripatus* that I know of are the young born imperfect in this respect. I therefore examined the number of legs of the oldest embryos in my specimens with great care, and the result of my observations is in entire contradiction to Ernst's statements. The embryos I found differ in the number of legs, just as do the adults, the greatest number being thirty-two pairs and the smallest twenty-nine. If this is so there can be no doubt that the new-born young differ in the same manner. To take an instance: from the lower end of the uteruses of the four specimens with thirty-two legs I obtained in all seven embryos, which were practically fully-developed and ready for birth. Of these, four had twenty-nine legs, two had thirty-one, and one had thirty-two—an embryo with twenty-nine and one with thirty legs were found in the same mother; and I have also found instances of a quite immature embryo (but possessed of the full number of legs) with a greater number of legs than the large mature embryo which occupied the part of the uterus.

1 The specimen which Gaffron used for his first paper was from Trinidad, and had thirty-two legs.
next the external opening. Considering the easy nature of the observations required, Professor Ernst's statements display a very extraordinary method of work.

**Colour.**—My observations on this point were made on spirit specimens, and cannot therefore have the value of those of Ernst, who had the living animals before him. He says: “The colour is brownish black, with a diffused black line on the middle of the back; the ventral side is dark flesh-coloured.”

In all my preserved specimens the colour was brown, darker in some than in others; in the specimen figured it is as dark as in any in my possession. The ventral surface, moreover, was of the same colour as the dorsal. As these specimens came from Caracas, and have become distinctly paler since I first saw them, it seems pretty clear that the colour of this species is much affected by spirit. It will be remembered the brown pigment of *P. capensis* was changed by the action of spirit. The same fact has been observed by Grube (see below, p. 480), who found that the pigment was partly dissolved by the spirit, and also by myself in some specimens brought alive from Demerara by Mr. W. L. Sclater (No. 41).

**The Ridges and Papillae of the Skin.**—The ridges are more clearly marked, and the papillae of the dorsal surface are less numerous. The dorsal white line is not present, so that the ridges are continuous right across the dorsal middle line. Further, there is for the most part only one row of papillae on each ridge, whereas in the South African and New Zealand species there is considerable irregularity in this respect. The fine diagonal lines, which break up the rows of papillae into lozenge-shaped areas, are absent in this species. The ridges extend for the most part right across the dorsal surface, but here and there, particularly at the level of the legs, there are accessory ridges extending across the middle line and stopping short a little distance on each side of it. They cause a slight deflection of the contiguous main ridges (fig. 6). Many of the papillae—particularly those on the legs—are divided by a constriction into two main portions (fig. 12)—
a free portion bearing the spine and a larger basal part. The basal part is cylindrical, and the terminal portion often of considerable size. Those immediately round the lips appear to be without this characteristic.

The antennæ present no features of specific interest. The tongue and lips are without pigment and have the typical form.

The jaws present differential characters. The outer blade (fig. 26) has a well-marked minor tooth in addition to the main one. On the inner blade the number of minor teeth varies (generally eight), and the anterior of them is close to the main tooth and larger than the rest, which are separated from it by a diastema (fig. 25).

The oral papillæ are normal.

A typical ambulatory appendage presents the following characters (fig. 12). The leg possesses four spinous pads, a strongly marked, rather deep groove in the position of the tumid papillæ of Capensis, i.e. a groove placed on the ventral surface of the leg, and extends from the opening of the nephridium as far as the third or fourth row of papillæ from the proximal pad. This groove may be widely open as in the leg figured, or its edges may be approximated so that it appears as a slit. The papillæ at its margin are somewhat larger and more indistinct than the ordinary papillæ. The foot resembles that of Capensis in possessing two papillæ on its anterior face, but the two basal papillæ are absent.

The opening of the segmental organ of the fourth and fifth legs is on a papilla which is placed on the proximal side of, and quite separate from, the third pad, between it and the proximal pad (fig. 11). This feature is found in all the neotropical species which I have examined. On certain of the posterior legs of the males there are two and sometimes one smooth white tubercle with an opening at their extremities (fig. 23). They are placed close behind the groove, and are found only on the posterior legs. Their exact arrangement varies in different individuals. To give examples:
In a male with 30 legs:

**Right side.**—Legs 21—24 inclusive, each had one such tubercle; legs 25—28 inclusive, each had two such tubercles; legs 29 and 30 were without them.

**Left side.**—Leg 21 had one tubercle; leg 22 was without one; legs 23 and 24 each had one; legs 25—28 inclusive, each had two; legs 29 and 30 were without them.

In another male with 30 legs:

**Right side.**—Leg 22 had one tubercle; legs 23—28 inclusive, each had two; legs 29 and 30 were without.

**Left side.**—Leg 22 had one; legs 23—28 inclusive, each had two; legs 29 and 30 were without them.

When one papilla only is present it is the distal one.

From these examples it is obvious that the arrangement of these tubercles is different not only in the different individuals but also on opposite sides of the same individual. The last two legs are always without them. Gaffron found precisely the same irregularity in the arrangement, but in his specimens they were symmetrical. In one with thirty legs, the twenty-second leg had one, and legs 23 to 28 each had two tubercles. While in another male with twenty-nine legs, leg 20 had only one, while legs 21 to 27 each had two. The pits at the apices of these tubercles are, according to Gaffron, the openings of glands corresponding to the crural glands of Capensis.

The legs of the last pair are smaller than the penultimate, and possess only two spinous pads. The legs of the penultimate pair are without the nephridial opening, and the pedal groove is inconspicuous as it is in the last pair. I could not satisfy myself whether the legs of the last pair possessed a nephridial opening; but Gaffron states that they possess a nephridium.

Gaffron (No. 35) describes a peculiar bean-shaped papilla, placed in a pit of the integument on the dorsal surface of the leg near the foot. Its surface is smooth as is also the lining of the pit in which it is placed. It is found in the Trinidad species, and may very probably turn out to be characteristic of the neotropical species.
Internal Anatomy.—Excepting the generative organs there is nothing in the internal anatomy of this species which deserves notice here. The generative organs, of which we have an excellent description by Gaffron, do, however, present some features of interest. The generative opening in both sexes is between the legs of the penultimate pair. The oviduct end of the ovary is directed forwards, and the ovarian ligament, which is attached to the opposite end of the ovary, is of great length, being attached to the pericardial floor between the twenty-fifth and twenty-sixth pairs of legs. A globular receptaculum seminis (with two short ducts) opens into the anterior part of each oviduct. Immediately in front of the receptacula each oviduct gives off a short diverticulum, called "caecum" by Ernst, "zipfelformige Anhang," and "ovarial-trichter" by Gaffron. Gaffron, who at first thought that this process opened at its free end into the body cavity, now accepts Kennel's statement that it opens into a small vesicle with extremely thin walls. Kennel calls this vesicle the receptaculum ovorum. I have seen the process, but, unfortunately, have no observations on its termination; but I am strongly inclined, on theoretical grounds, to think that Kennel is correct in his statement as to the delicate vesicle. The generative ducts are the modified nephridia of the segment on which the external opening is placed: this is proved, on the one hand by their development, and on the other by the fact that nephridia are absent from the penultimate legs, between which the generative opening is placed. Now, it has been shown by me (No. 39) that all the nephridia open internally, not into the body cavity as has been supposed, but into a small vesicle with extremely delicate and thin walls. It thus appears that the presence of this delicate vesicle of the receptaculum ovorum is another proof—if another were wanted—that the oviducts of Peripatus are modified nephridia. No such structure has been found in the New Zealand species, but, possibly, further investigations may come upon it. In Capensis, for reasons which I have set forth elsewhere (No. 39, Part 3), one would not expect to find this structure.
The male organs differ from those of the Cape species and resemble those of the New Zealand species in the fact that the common posterior part of the testicular ducts is of great length. A very good description of it has been given by Gaffron. A pair of accessory glands is present in the male. They open on each side of the anus (Gaffron).

Nephridia are present in the legs of the last pair but are absent from the penultimate legs, between which the generative opening is placed (Gaffron, No. 35). With regard to the crural glands, Gaffron states that they are absent from the female, and only present in the males in those legs provided with the tubercles described above.

The ova are small and without yolk. Their development has been described in a closely-allied species from Trinidad by Kennel, according to whom the embryos acquire a placental connection to the uterine wall and an amnion. These structures are, however, said to disappear after a certain stage is reached, and there is reason to doubt whether they have the relations, significance, and method of development which Kennel ascribes to them (Sclater, No. 46).

The uterus contains embryos in all stages of development, and the young, which are fully developed at birth, are presumably born at different times of the year.

The length of mature embryos of Peripatus Edwardsii, lying stretched out in the uterus with head near generative opening, is about 20 mm.

The length of a large adult female is 55 to 60 mm. The males, of course, are rather smaller.

Habits.—The habits of this species are apparently much the same as in the other species. A large number of specimens were found by Ernst in a yard of the University building of Caracas under heaps of rubbish.

Peters (No. 24) mentions specimens from the following localities in Venezuela:—Caracas, Puerto Cabello, Laguayra. He states that some of the specimens from Puerto Cabello have thirty and others thirty-two pairs of legs.
Peripatus from Demerara.

In January of this year (1887) Mr. W. L. Sclater brought to England twenty female specimens of *Peripatus* collected at Maccasseeema, on the Pomeroon River. The specimens, when they came into my hands, were torpid and apparently at the point of death, and it was necessary to open them at once and remove the embryos. I was unable therefore to make a detailed examination of them in the fresh state.

Mr. Sclater has already (No. 41) given a short description of the specimens. To his description I add here notes of my own observations, made on the first arrival of the animals, and an account of those which I have since made on their preserved bodies.

All the specimens (twenty in number) were females. The colour was a dark brown on the dorsal surface, with a median diffuse dark stripe, such as Ernst describes. The antennae were of a darker colour than the rest of the body. The ventral surface was higher than the dorsal—a kind of flesh colour. The animals turned quite red in spirit, and the red colouring matter was gradually dissolved by the spirit leaving them a lighter brown.

In well-grown specimens the uterus contained ten embryos in each horn, of which the fifth from the ovary was generally in the spiral stage. The receptacula ovorum seemed to contain ova, which were 0.038 mm. in diameter. The large eggs in the ovary were the same size.

In one specimen, which I carefully examined for the purpose, there were cilia in the receptacula seminis in the position described by Gaffron. There can be no doubt of their presence. I saw them in active movement. I am very glad to have had the chance of confirming Gaffron on this point. The older embryos had the same colour as the adult. I could not be certain of the presence of spermatozoa in either the receptaculum seminis or in the oviduct. If present at all, they must have been few in number.
To these observations I have now the following to add: The colour, under the prolonged action of spirit, has become lighter. The antennæ, oral papillæ, jaws and legs, resemble in all respects the same structures in the Caracas specimens. The grooves on the legs were for the most part closed and therefore slit-like. None of them possessed tubercles.

Mr. Sclater has the following statement on the slits and tubercles. "In my specimens and in that from Dominica, the openings (i.e. the slits) are in many cases rounded, and sometimes have attached to them a bladder-shaped appendage." I do not quite understand this passage, but if it means that the slits are round openings and that there are tubercles in the specimens he brought from Demerara, I cannot confirm his statement. It is unfortunate that no males are to hand, as it is important from a systematic point of view to know if they have the tubercles such as are found in the Caracas species, and if they differ from the females in the number of legs. The length of a large specimen was 55 to 60 mm.

Mr. Sclater states that all the specimens examined by him, including those taken from the uterus, had thirty pairs of legs. Mr. Sclater's observations must have been confined to a very small number of his specimens. I examined fourteen adults: of these seven had thirty pairs of ambulatory legs, six had thirty-one, and one had twenty-seven. Out of thirteen embryos examined seven have thirty pairs and six have thirty-one. Unfortunately, I did not notice that the adults varied in the number of their legs, until after the embryos had been removed from all except the specimens with twenty-seven pairs of legs; so that it was not possible to determine, excepting in this case, whether the young resembled their parents in this respect. Out of four embryos which had already developed the full complement of legs and were removed from the specimen with twenty-seven pairs, three had twenty-seven and one had twenty-eight pairs of ambulatory legs, so that it appears that the number of legs varies in the species.

The only other difference between these specimens and those from Caracas that I could detect, related to the primary
papillae on the skin. In the Caracas species, as already mentioned, these have comparatively narrow cylindrical bases, and the diameter of the tops is often almost as great as that of the basal portion. In the Demeraran specimens, on the other hand, the lower portion of the papillae have the form of truncated cones with very broad bases, while the tops are relatively, and I think absolutely, much slenderer than in the Caracas specimens. The papillae figured by Gaffron (No. 34, Pl. VII, and here reproduced fig. 27) resemble those of the Demerara specimens, and will serve for comparison with the papillae of the Caracas specimens shown on Pl. XXXVIII, fig. 12. I propose provisionally to regard these specimens as belonging to a distinct species, and to call it *P. demeraranus*\(^1\) with the following characters. Neotropical *Peripatus* with twenty-seven to thirty-one pairs of ambulatory legs and cylindrical primary papillae. Locality Maccasseema, Demerara.

**Peripatus from Trinidad.**

Dr. J. v. Kennel (No. 31) found two distinct species of *Peripatus* in Trinidad; one of these he calls *P. Edwardsii* and the other *P. torquatus*. His description of both is unfortunately extremely meagre.

The species which he calls Edwardsii possesses twenty-eight to thirty pairs of legs (No. 32). The generative opening is between the legs of the penultimate pair, and the generative organs present the characters of the Neotropical species.

Dr. Kennel was kind enough to send me two of this species in spirit, and I am able to supplement his description.

\(^1\) Sclater (No. 46) gives the name *im Thurmi* to the specimens with thirty pairs of legs, which he has observed. It is of course quite possible that the specimens with thirty pairs may be specifically distinct from those with twenty-seven and thirty-one pairs. This, however, as stated above, I do not regard as probable. On account of this uncertainty, and also because of the further uncertainty as to whether the Demeraran specimens are specifically distinct from species already determined and named, I propose the provisional name of *Demeraranus* to include all specimens from Demerara, whether the number of legs be twenty-seven, thirty, or thirty-one pairs.
One of these specimens had thirty-one pairs of legs and the other thirty, from which it appears that Kennel, like so many other zoologists who have examined *Peripatus*, has not been very careful in counting the legs. The dorsal surface was of a chocolate colour, the ventral surface being a light brown. The papillae and ridges of the skin presented the features characteristic of the Neotropical species. The bases of the primary papillae are conical as in *Demeraranus*. The jaws also presented no points of difference from those of the species from Caracas, excepting that possibly the number of minor teeth was rather larger: in one I found as many as eleven.

I think there can be no doubt that this is a distinct species, and I propose to call it and define it as follows:

**Peripatus Trinidadensis** *(Edwardsii, Kennel).*

*Peripatus* from Trinidad, with twenty-eight to thirty-one pairs of ambulatory legs, and a large number of minor teeth on the inner blade of the jaw. The basal portions of the primary papillae are conical.

**Peripatus torquatus** *(Kennel).*

*Peripatus* from Trinidad of large size, with forty-one to forty-two pairs of ambulatory legs. The head is marked off from the body by a bright yellow band on the dorsal surface.

The larger species is named *P. torquatus*, and Kennel gives the following description of it. "The females reach the length of 15 cm., with a diameter of 8 mm., while the males have a length of about 10 cm. The colour of the dorsal surface is red brown, the middle line of the back being somewhat darker, and paling off towards the sides. The head with the tentacles is black and is marked off from the body on the dorsal side by a bright yellow band, which often shows a small interruption in the middle line. The ventral surface has a dark flesh colour. There are forty-one or forty-two pairs of legs.

This completes the list of the Neotropical *Peripatus* of which we have anything like detailed knowledge. The remain-
der of this monograph will be devoted to a statement of all that is known with regard to the specimens found in other localities.

1. The original species found by Guilding (No. 1) in the forests of the Island of St. Vincent in the Antilles, and called by him *P. juliformis*, possessed thirty-three pairs of legs, and a dark line down the centre of the back. The generative opening is apparently immediately in front of the penultimate legs. The animal was of a fair size, being three inches in length by three lines in breadth. It is apparently similar in all essential respects to other neotropical *Peripatus*, and I am inclined to maintain for the present the species, and to define it as follows:

*Peripatus juliformis* (Guilding).

*Neotropical Peripatus from St. Vincent, with thirty-three pairs of ambulatory legs.*—This definition is exceedingly unsatisfactory because it is based on the number of legs, which, as I have stated, varies in all the species which have been closely examined.

2. The species described by Audouin and Milne-Edwards (No. 2) possessed thirty pairs of ambulatory legs, and came from Cayenne (on the banks of the River Approuague, three leagues from its mouth). The specimens were found "unter faulem, im Schlamm versehünenem Holze, an den Ufern des Approuage im Brackwasser."

The description is very imperfect, as may be judged from the fact that the generative aperture is not even mentioned.

The species was regarded by the authors as identical with Guilding’s *P. juliformis*, but subsequently Blanchard (No. 8) gave it the name of *P. Edwardsii*. I propose to retain the latter name and to regard it as belonging to the same species which I have fully described above from Caracas.

It must, however, be remembered that the characters of *P. Edwardsii*, as given in this monograph (p. 467) are based on the Caracas specimens; and it may quite well happen that the
Peripatus found at Cayenne, when better known, will turn out to be a distinct species.

3. Wiegmann (No. 4) obtained a specimen of Peripatus from near the Valentina Lake in Columbia, with thirty pairs of legs. It is quite impossible to say whether this is a distinct species or not. It possesses, according to Wiegmann's description, four spinous pads on its legs and a generative opening between the legs of the penultimate pair.

4. C. Mority (No. 5) obtained a large number of Peripatus from the Island of St. Thomas. He gives no details.

There is a specimen in the British Museum from St. Thomas. It has twenty-eight pairs of ambulatory legs, and is of a yellowish-brown colour, but is unfortunately too ill-preserved for determining any specific characters.

5. Peters (No. 24) mentions specimens from Utuado, Porto Rico, and gives the following particulars.

<table>
<thead>
<tr>
<th>Specimens</th>
<th>21 mm. in length had 27 pairs of legs.</th>
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<td>33 mm. &quot; &quot;</td>
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<tr>
<td>38 mm. &quot; &quot;</td>
<td>31 &quot; &quot;</td>
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<tr>
<td>42–48 mm. &quot; &quot;</td>
<td>32 &quot; &quot;</td>
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6. Blanchard (No. 8) has described a Peripatus found in Chili by M. Claude Gay, with nineteen pairs of legs. His description is as follows:—"Le corps est long de 30 à 32 mill., et large de 5 à 6, légèrement atténué aux deux extrémités, mais surtout vers la partie postérieure. Sa couleur est noire, un peu variée irrégulièrement de taches roussâtres. La tête est presque carrée avec les antennes amincies vers le bout, présentant des annulations très serrées. L'orifice buccal est ovale. Les pattes sont au nombre de dix-neuf paires, ciliées de poils raides comme de petites pointes, et terminées par des crochets."

There is obviously nothing in this description which enables us to say whether the three specimens at the author's disposal possessed the characters of the Neotropical species or not. It is extremely probable, considering the remoteness of the locality, that this is a distinct species; but unfortunately
Blanchard has not, with the exception of a name, assigned to it any feature which can be in the least degree regarded as specifically distinctive. He calls it *P. Blainvillei*, and says that it has nineteen pairs of legs. The name I propose to discard, and the statement of fact I am inclined to doubt, for this reason:—In Gay's 'Historia de Chile,' vol. iii, "Zoología," p. 58, there is a description of this proposed new species, and the possession of nineteen pairs of legs is given as a character. I presume Blanchard is responsible for this statement as it coincides with that given in No. 8. In the description reference is made to some figures in the Atlas. These turn out to be a dorsal, ventral, and side view, &c., of the specimen described. Will it be believed that not only does each of these figures show a different number of legs, but in the case of the dorsal and ventral views, the numbers on the right and left sides are different? The details are as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Right Side</th>
<th>Left Side</th>
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<tbody>
<tr>
<td>Dorsal view</td>
<td>27 legs</td>
<td>26 legs</td>
</tr>
<tr>
<td>Ventral view</td>
<td>33 legs</td>
<td>31 legs</td>
</tr>
<tr>
<td>Side view of left side</td>
<td>20 legs</td>
<td></td>
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</tbody>
</table>

I do not know who is responsible for these figures. The draftsman's name on the plate is Spinola. I need hardly say that, if they are a fair sample of the drawings in the Atlas, the zoological plates are not worth the paper they are printed on.

It will, perhaps, be convenient to denote the fact that there is a *Peripatus* in Chili, by introducing for it the provisional name of *Peripatus chiliensis*.

7. Blanchard refers to a *Peripatus* found in Cuba by M. Macleay. He regards it as belonging to the species *juliformis*. I have been unable to find any account of this Cuban species.

8. Grube (No. 11) describes three specimens of *Peripatus* from near Colonia Towar, in Venezuela, and referred them to *P. Edwardsii*. One of the specimens possessed twenty-nine pairs of legs and the other two thirty each. But one cannot regard his statements on this head as being trustworthy, in-
asmuch as the specimen he has figured has thirty-one pairs
(in addition to the oral papillæ).

He found a number of embryos in the uteruses of his specimens, all of which, excepting one with thirty, possessed thirty-one pairs of legs.

His statement on the colour is interesting, as tending to show that the pigment in this species is affected by the prolonged action of spirit. He says:

"Die Farbung war an einem sehr frisch erhaltenen Wein-geist exemplar ein dunkles unreines Kirschroth, der Weingeist, indem es lag, hatte sich blassroth gefärbt, bei denen die längere Zeit aufbewahrt waren, ging der Ton in's Braunlichgrue über, doch blieb die Ruckenseite immer sehr viel dunkler als die Bauchseite, auch zeigte sie beständig die schon von den früheren Beschreibern erwähnte mittlere Längsfurche von noch dunklerer Farbe, rechts und links von ihr in einiger Entfernung sieht man gewöhnlich noch eine dunkle Seitenlinie."

I cannot be quite certain from Grube's figures whether the papillæ have the form characteristic of the Caracas species or of the Demerara form.

The species possesses all the Neotropical characters, viz. inner blade of jaw with minor teeth separated by diastema from the first small tooth, legs with four spinous pads, generative opening between the penultimate pair of legs, oviducts with receptaculum and process, embryos in uterus of very various ages.

I propose, therefore, to retain provisionally Grube's name for the specimens from Colonia Towar, and to regard them as belonging to the species found at Caracas, and described above as *P. Edwardsii*.

9. Mr. Thomas Belt found a specimen of *Peripatus* at Santo Domingo, in Nicaragua. The specimen (dried) is referred to in his work, 'The Naturalist in Nicaragua' (p. 140), and has been examined by Professor Moseley, who found that it possessed thirty-one pairs of ambulatory legs.
P. quitensis (Schmarda).

10. Professor Jeffrey Bell has recently (No. 43) drawn attention to a reference by Schmarda in his 'Zoology' (No. 42) to a species with thirty-six pairs of legs from Quito, in Ecuador. Schmarda gives a figure of the specimen, which came from an elevation of 9000 feet.

Neotropical Peripatus in the British Museum.

1. Specimen from Dominica found by Mr. G. F. Angas. This specimen is in excellent condition, and has twenty-nine pairs of ambulatory legs. It has been shortly described by Professor Jeffrey Bell (No. 29), who says that it has thirty pairs of legs. This may be so, but I could not make out more than twenty-nine. The dorsal surface is brown, and there is a dark streak (chocolate-coloured with a dash of purple) running along the sides of the body just dorsal to the legs. The legs are without tubercles. The pedal grooves are widely open. The papillae are, I think, conical in form; but the light was not good enough to enable me to obtain certainty on this point.

2. A specimen marked P. Blainvillei, without locality. This has thirty-three pairs of ambulatory legs, and is of a reddish-brown colour. It is very much contracted. There were no tubercles, and I was not able to make out the shape of the papillae.

3. A specimen marked P. Blainvillei, without locality (see above, p. 479), with twenty-eight pairs of ambulatory legs.

4. There are three specimens in a bottle labelled "From Jamaica," collected by Gosse. They are all a yellowish brown. Two of them have thirty-one and one thirty-seven pairs of ambulatory legs. The latter is remarkable as being the smallest of the three, measuring in the contracted condition 22 mm. Of the two with thirty-one pairs of legs, the largest measured about 48 mm., and the other about 22 mm. The papillae were conical and there were no tubercles. Mr. Gosse, in 'A Naturalist's Sojourn in Jamaica' (P. H. Gosse, London, Longmans, 1851,
p. 62), refers to these Peripatus in the following terms: "Peripatus found at Bluefields mountain above Bluefields House, near the town of Savanna lo Mar. The mountain height is four or five miles from Bluefields. Here, around a piece of burnt ground just reclaimed from the forest, but not yet planted, were found, under stones, five or six specimens of Peripatus, one twice as large as any of the others. The piece of ground lay at the foot of a conical peak of considerable elevation, but not the very loftiest, covered with original forest. It is a curious creature, and I think rather allied to the Annelida than the Mollusca. It is of a velvety appearance, of a blackish-brown hue, the tentacles tipped with white. From these latter organs there exudes, when the animal is touched, a thick glutinous substance, as adherent as birdlime." He concludes that it is of a different species from that found by the Rev. L. Guilding at St. Vincent.

5. A specimen labelled "Peripatus juliformis, West Indies, Mr. Gibson, Nereis viridis, Adams, 'Linn. Trans.,' feet only thirty-one pairs."

This specimen was about 65 mm. in length, 5½ in breadth, 5 in dorso-ventral depth; i.e. it was cylindrical in form. It possessed thirty-two pairs of ambulatory legs, and has a very pale brown colour (almost white). Its skin is much smoother than is generally the case.

The legs have four spinous pads, and are without tubercles; the generative opening is between the legs of the penultimate pair; the integumentary papillae are constricted; the legs of the last two pairs are very small. It clearly, therefore, belongs to a typical Neotropical species, but more than this cannot be said.

6. A smaller specimen with thirty pairs of ambulatory legs of very much the same colour and form. It was labelled, "Peripatus juliformis, Guild., W. Indies? Sloane collection."

It possesses thirty pairs of legs. The generative opening is between the legs of the penultimate pair. The grooves on the base of the legs fairly well marked. Feet not sufficiently well preserved for study (claws broken away). The integu-
mentary papillae constricted, and arranged on the dorsal surface in regular rows. Length about 48 mm.; body cylindrical in shape with a diameter of about 4 mm. The legs are without tubercles.

7. Finally there is a specimen labelled "Peripatus Santarem, Wickham, purchased of W. H. J. Carter." It has thirty-one pairs of ambulatory legs, and presents, so far as its external features are concerned, the Neotropical characters. The papillae are conical, and the legs are without tubercles.

Professor Strunstrip was kind enough to send me for examination the specimens in his museum. I desire to take this opportunity of thanking him for his courtesy and kindness in the matter. The Copenhagen specimens were in four bottles: (1) Label "Peripatus Edwardsii, Bl., Vestindien, Kröyer." This was a fine, well-preserved specimen, with thirty-one pairs of ambulatory legs, and a brown colour. The dorsal surface was darker than the ventral. The dorsal papillæ were remarkably large (fig. 14) and constricted, as were also the ventral, but less markedly. The generative opening was between the legs of the penultimate pair, and the spinous pads of the legs were four in number.

(2) Label "Peripatus Edwardsii, Blanch., St. Croix, Kröyer." This specimen, which in general appearance resembled the first, but was smaller, possessed twenty-seven pairs of ambulatory legs. Spinous pads and generative opening as in (1).

(3) Label "Peripatus Vestindien, Hombek (?)." With thirty-two pairs of ambulatory legs.

(4) The specimen in the fourth bottle was not sufficiently well preserved for observation.

It is unfortunate that the exact localities of the above were not recorded. They are obviously all Neotropical species, but to which of these they belong cannot be at present settled.

Four specimens of Peripatus, of which one had thirty-one pairs of legs, are reported from Demerara (Hoorubea Creek, twenty miles from Georgetown, on east side of Demerara river), by Mr. J. J. Quelch (No. 36). No details are given.
A single specimen was found at Breves, on the Island of Marajo, at the mouth of the Amazon, by Mr. J. C. Branner (No. 37). No details are given.

**Peripatus Sumatranus.**

A single specimen of *Peripatus*, stated to have come from Sumatra, has recently been described by Dr. R. Horst (No. 38). The evidence that the specimen was actually found in Sumatra is not, however, conclusive. Dr. Horst states that it was found in a bottle containing insects from East Sumatra. The name of the finder is not given, and there is no evidence to show how the specimen got into the bottle. Considering the fact that this is the only specimen of *Peripatus* ever reported from the Oriental region, it will be prudent to suspend our judgment as to the authenticity of the locality given by Dr. Horst. The specimen has twenty-four pairs of ambulatory legs, and is 25 mm. in length. The papillae are constructed as in the Neotropical species, and are apparently on the cylindrical type. Dr. Horst describes them as "appearing to consist of a truncated cone, bearing on its top a small cylinder provided with a spine." The legs have four pads, the generative opening is between the legs of the penultimate pair. All these are Neotropical characters. The anus is not quite terminal. Colour is dark blackish brown; the ventral surface is paler, greyish. "Some small white spots scattered on the dorsal surface, but they seem only to be produced by the loosening of the cuticle from the top of the papillae." The foot carries only two papillae, one on the anterior and one on the posterior face. This is unique so far as my experience of *Peripatus* goes. The pedal groove is absent from the two posterior legs as in *P. Edwardsii*. The antennae have forty-seven rings.

I think that there can be no doubt that this is a distinct species. It is the only specimen hitherto recorded from the oriental region, and it seems a fact of extreme interest that it should resemble the Neotropical species more than any other. It is a great misfortune that Dr. Horst was not able to examine the jaws and generative organs.
Peripatus sumatranus (Horst).

*Peripatus* from Sumatra, with twenty-four pairs of ambulatory legs, four pads on the legs, and constricted papilla. The generative opening is between the legs of the penultimate pair. The feet have only two papillae.

SYNOPSIS OF THE SPECIES OF PERIPATUS.

**South African Species.**

With three spinous pads on the legs and two primary papillae on the anterior side of the foot, and one accessory tooth on the outer blade of the jaw; with a white papilla on the ventral surface of the last fully developed leg of the male. Genital opening subterminal, behind the last pair of fully-developed legs. The terminal unpaired portion of vas deferens short. (Ova of considerable size, but with only a small quantity of food-yolk.

P. capensis (Grube).—South African Peripatus, with seventeen pairs of claw-bearing ambulatory legs. Locality, Table Mountain.

P. Balfouri (Sedgwick).—South African Peripatus, with eighteen pairs of claw-bearing ambulatory legs, of which the last pair is rudimentary. With white papilla on the dorsal surface. Locality, Table Mountain.

P. brevis (De Blainville).—South African Peripatus, with fourteen pairs of ambulatory legs. Locality, Table Mountain. (I have not seen this species. Presumably it has the South African characters.)

P. Moseleyi (Wood Mason).—South African Peripatus, with twenty-one and twenty-two pairs of claw-bearing ambulatory legs. Locality, near Williamstown, Cape Colony.

**Doubtful Species.**

(1) South African Peripatus, with twenty pairs of claw-bearing ambulatory legs (Sedgwick). Locality, Table Mountain. (Also Peters, locality not stated.)

(2) South African Peripatus, with nineteen pairs of ambulatory legs (Trimen). Locality, Plettenberg Bay, Cape Colony. (Also Peters, locality not stated.)

**Australasian Species.**

With fifteen pairs of claw-bearing ambulatory legs, with three spinous pads on the legs, and a primary papilla projecting from the median dorsal portion of the feet. Genital opening between the legs of the last pair. (Receptacula
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semis present. Unpaired portion of vas deferens long and complicated. Ova large and heavily charged with yolk.

P. Nova-zelandiae (Hutton).—Australasian Peripatus, without an accessory tooth on the outer blade of the jaw, and without a white papilla on the base of the last leg of the male. New Zealand.

P. Leuokarti (Saenger).—Australasian Peripatus, with an accessory tooth on the outer blade of the jaw, and a white papilla on the base of the last leg of the male. Queensland.

Neotropical Species.

With four spinous pads on the legs, and the generative aperture between the legs of the penultimate pair. Dorsal white line absent. Primary papilla divided into two portions. Inner blade of jaw with gap between the first minor tooth and the rest. Oviducts provided with receptacula ovariurn and seminis. Unpaired part of vas deferens very long and complicated. Ova minute, without food-yolk. (Legs not constant in number in the same species.)

P. Edwardsii.—Neotropical Peripatus from Caracas, with a variable number of ambulatory legs (twenty-nine to thirty-four). Males with twenty-nine or thirty legs, and tubercles on a varying number of the posterior legs. The basal part of the primary papilla is cylindrical.

P. Trinidadensis (n. sp.).—Neotropical Peripalus from Trinidad, with twenty-eight to thirty-one pairs of ambulatory legs, and a large number of teeth on the inner blade of the jaw. The basal portion of the primary papilla is conical.

P. torquatus (Kennel).—Neotropical Peripatus from Trinidad, with forty-one to forty-two pairs of ambulatory legs. With a transversely placed bright yellow band on the dorsal surface behind the head.

Doubtful Species.

The above are probably distinct species. Of the remainder we do not know enough to say whether they are distinct species or not. The following is a list of these doubtful species, with localities and principal characters.

P. juliformis (Guilding).—Neotropical Peripatus from St. Vincent, with thirty-three pairs of ambulatory legs.

P. Chilienneis (Gay).—Neotropical Peripatus from Chili, with nineteen pairs of ambulatory legs.

P. demeraranus (Sclater).—Neotropical Peripatus from Maccacessa,

1 This name was first applied by Blanchard (No. 8) to a species from Cayenne (vide above, p. 478). The description, however, is very imperfect, and it is by no means clear that the Cayenne species is identical with the species here named Edwardsii.
Demerara, with twenty-seven to thirty-one pairs of ambulatory legs and cylindrical primary papilla.


Peripatus from Valenti Lake, Columbia (Wiegmann).—With thirty pairs of legs. Doubtful species.

Peripatus from St. Thomas (Moritz).—No description. Doubtful species.

Peripatus from Colonia Tovar, Venezuela (Grube).—With twenty-nine to thirty-one pairs of ambulatory legs. Named P. Edwardsii by Grube. Doubtful species.

Peripatus from Santo Domingo, Nicaragua (Belt).—With thirty-one pairs of ambulatory legs. Doubtful species.

Peripatus from Dominica (Angas).—Neotropical Peripatus, with twenty-nine pairs of ambulatory legs. Doubtful species.

Peripatus from Jamaica (Gosse).—With thirty-one and thirty-seven pairs of ambulatory legs. Species doubtful.

Peripatus from Santarem.—Neotropical Peripatus, with thirty-one pairs of ambulatory legs.

Peripatus from Cuba.—No details.

Peripatus from Hoorubea Creek, Demerara (Quelch).—With thirty pairs of legs.

Peripatus from Marajo (Branner).—No details.

Peripatus from Utuado, Porto Rico (Peters).—With twenty-seven, thirty, thirty-one, and thirty-two pairs of legs.

Peripatus from Surinam (Peters).—No details.

Peripatus from Puerto Cabello, Venezuela (Peters).—With thirty and thirty-two pairs of legs.

Peripatus from Luguayra, Venezuela (Peters).—No details.

Peripatus Quitensis (Schmarda).—From Quito, with thirty-six pairs of legs.

Peripatus from Sumatra.

P. Sumatranus (Horst).—Peripatus from Sumatra, with twenty-four pairs of ambulatory legs, and four spinous pads on the legs. The primary papilla of the neotropical character with conical bases. Generative opening between the legs of the penultimate pair. Feet with only two papillae.

SUMMARY OF DISTRIBUTION.

Distribution of the South African Species—

Slopes of Table Mountain, neighbourhood of Williamstown, Plettenberg Bay—Cape Colony.
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Distribution of the Australasian Species—
Queensland—Australia.
North and South Islands—New Zealand.

Oriental Region—
Sumatra.

Distribution of the Neotropical Species—
Nicaragua.
Valencia Lake, Caracas, Puerto Cabello, Laguayra, Colonia Towar—
Venezuela.
Quito—Ecuador.
Maccasseema, Hoorubea Creek—Demerara.
Surinam (Peters).
Cayenne.
Santarem, Marajo at the mouth of the Amazon—Brazil.
Chili.

and in the following West Indian Islands—Cuba, Dominica, Porto Rico
(Peters), Jamaica, St. Thomas, St. Vincent, Trinidad.

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